# PANTHER™

## Installer's Handbook

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# *Installer's Handbook*

Second Edition, June 20, 1988

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## Approvals

Since the electromagnetic fields produced by Panther are less than or equivalent to SENTRAX (Senstar's long ported coaxial sensor), Panther complies with all of the radio regulatory approvals granted to SENTRAX as listed below:

USA: FCC Radio Regulatory Approval, Report and Order in GEN Docket 82-827, FCC 83-406 (August 27, 1984).
CANADA: DOC Radio Regulatory Approval, Radio Equipment Certificates K8510 and K8511.
GREAT BRITAIN: Department of Trade and Industry type approval, Radio Regulatory Approval Reference RD/EU/3651.
BELGIUM: RTT Radio Regulatory Approval, Certificat d'homologation RTT/D/X0143.
NETHERLANDS: Staatsbedrijf Der Posterijen Telegrafie en Telefonie Goedkeuringsnummer:
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Other international approvals are available.

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| 4,710,753 | United States of America |
| 2,120,823 | United Kingdom |
| 2,163,580 | United Kingdom |
| 2,165,681 | United Kingdom |

Patents pending in many countries of the world.

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# Using this Handbook

# Using this Handbook


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## Before You Start

You should read this book if you are:

- an installer
- a system designer

**What is Panther?**

Panther is the most advanced outdoor intrusion detection system available. It uses buried sensor cables and radar-like detection to provide intelligent perimeter protection. It detects human intruders silently and invisibly while ignoring birds, small animals and other disturbances which can cause false alarms in other systems.

Panther's buried sensor cables can be hidden in soil, concrete or asphalt to protect up to 300 m (984 ft) of perimeter. Intruders are detected the instant they cross the cables.

Panther can be used as a stand-alone system or in conjunction with other sensors such as door contact closures, microwave motion detectors, and so on.

This book will make your job easier to do. It tells you how to:

- lower the cost of installation
- reduce installation time
- have trouble-free installations
- eliminate call-backs
- solve site problems quickly

It is assumed that you are an experienced alarm system designer or installer. If you would like a non-technical explanation of Panther, consult the list of related publications provided in this section.

**Metric Conversion Rules**

This handbook uses the following rules for converting between imperial and metric measurements:

- all linear measurements are given using the metric system
- equivalent foot and inch measurements are provided
- for lengths greater than 10 m, the conversion factor used is 3.28 feet per meter
- for lengths less than 10 m, the conversion factor is 3 ft, 3 in per meter
- conversions for lengths greater than 10 m are rounded to the nearest foot
- conversions for lengths less than 10 m are rounded to the nearest inch
- conversions for lengths less than 1 m are rounded to the nearest fraction of an inch

**Note:** Where doubt exists about the accuracy of a conversion, the metric measurement should be taken as correct.

## How to Use this Handbook

This handbook contains a Reader's Road Map which tells you what to read when you need to "brush up" on your knowledge of Panther. The road map is helpful when you're:

- going through the first time
- getting ready to do an installation
- doing an installation
- starting up and testing the system
- solving site problems
- in need of a quick review

### Using the Installer's Checklist

A comprehensive installation checklist is included at the back of this handbook. As you become more experienced at installing Panther, you will find that the checklist is all you need to install trouble-free systems. Each item on the checklist has a page number which tells you where the item is discussed in the handbook.

If you're looking for specific information, the Table of Contents at the front of this handbook will help you find what you're looking for. If you come across terms you're unfamiliar with, consult the Glossary of Terms at the back of the handbook.

**What this Handbook Describes**

Using This Handbook:

- the section you're reading right now
- how this handbook is organized
- conversion rules
- maps of routes you can follow through the handbook

How Panther Works:

- an overview of Panther operation
- operation of the detection unit
- how the sensor cables work
- perimeters, zones and loops

Getting Ready:

- how to check system design
- guiding principles for system design and installation
- parts you will need
- tools and materials you will need

Installing the Cable Fittings:

- connector installation
- terminator and decoupler installation

Laying Out the Cable Route:

- surveying the site
- marking cable routes
- avoiding obstacles

Installing the Cables:

- preparing cables
- cutting slots or trenches
- bypassing problem areas
- running lead-in cable indoors

Installing the Detection Unit:

- mounting the detection unit
- connections to external devices
- installing supervision resistors
- using the option selection switch

Starting Up and Setting Sensitivity:

- setting up equipment
- setting sensitivity
- how to improve sensitivity
- system testing

Troubleshooting and Repair:

- solving power failures
- identifying and solving alarms
- repairing and replacing equipment

Sample Installations:

- case studies based on actual Panther installations
- sample site plans and completed checklists
- order of events during installations

Installer's Checklist:

- step-by-step instructions
- brief reminders of standard procedures and techniques

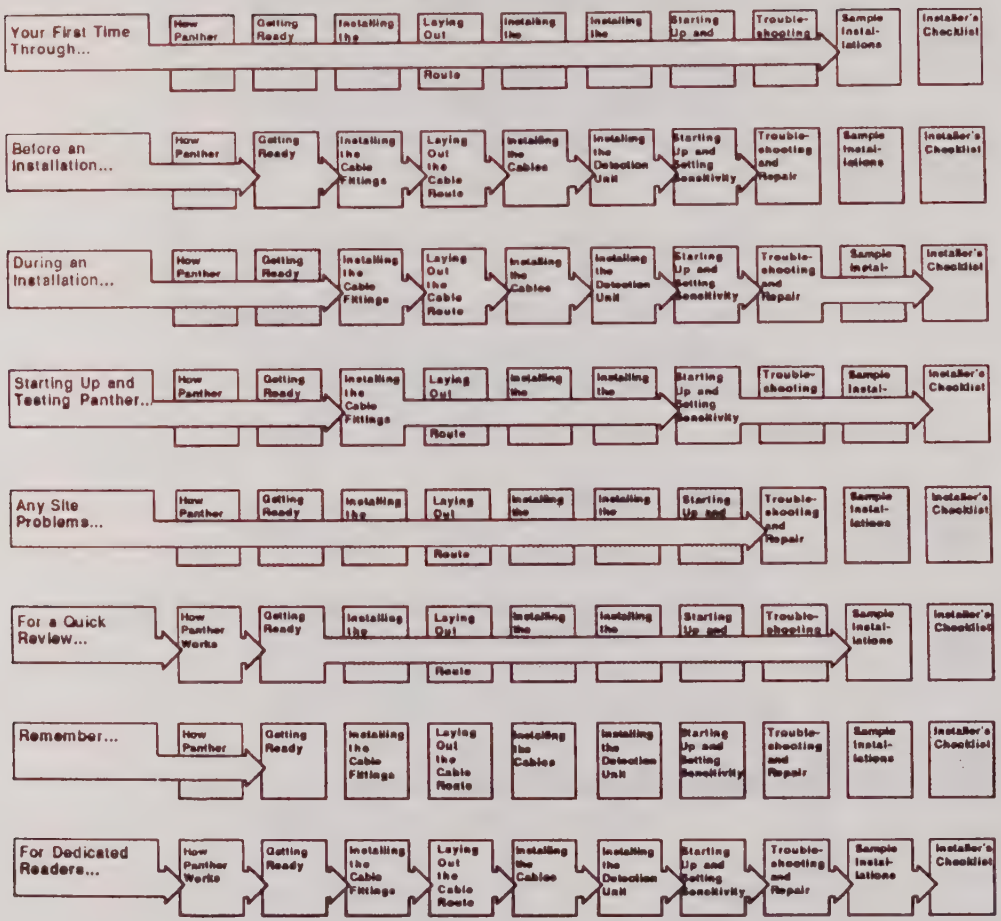
Glossary of Terms:

- definition of terms used in this handbook

Index:

- alphabetical list of topics

## Panther Installer's Handbook
## Reader's "Road Map"



# Related Panther Publications

**Panther Application Guide**

Written for the salesperson and system designer, the Application Guide contains information about:

- how Panther works
- Panther's features
- identifying potential customers
- rules for designing trouble-free installations
- sample applications
- planning a customer's site
- how to prepare a customer quote and order parts

**Panther Owner's Guide**

Written for the end user and shipped with every Panther detection unit, the Owner's Guide tells the user about:

- how Panther works
- how alarm systems work
- Panther's special features
- what the controls and indicators are for
- how to test and adjust Panther's operation
- routine maintenance
- a few troubleshooting techniques

# How Panther Works

# How Panther Works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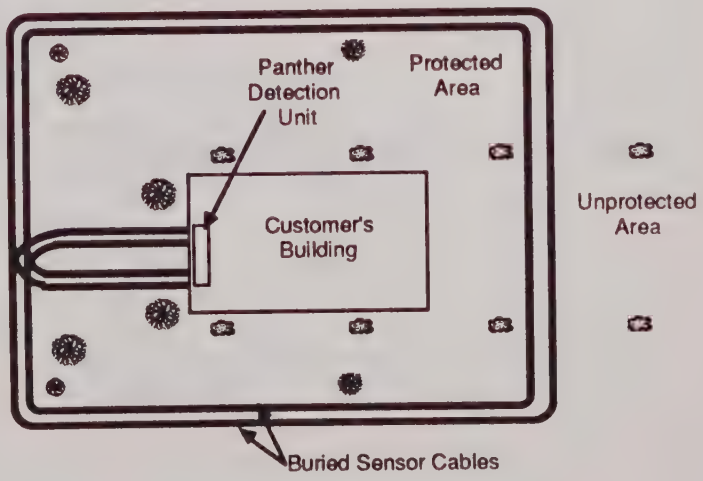
# General Theory

It helps to know some of the theory behind Panther before you design a comprehensive alarm system for your customer.

## The Detection Unit

In a typical Panther installation, the Panther detection unit is mounted inside a building on the customer's site. The detection unit is connected to sensor cables buried around the perimeter of the site. An example is shown below. Panther detects any intruder crossing over the cables and signals an alarm via an alarm panel or annunciator.

Detection Unit Connected to Sensor Cables



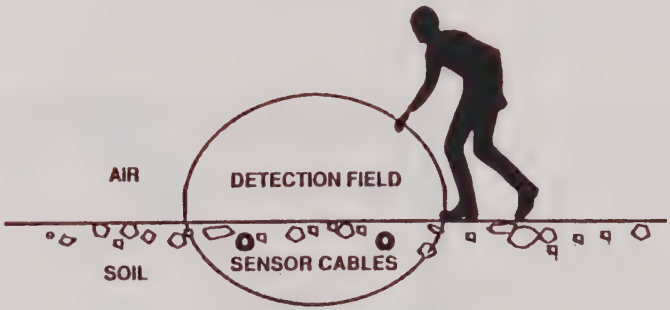

**NOTE: Details have been simplified**

**Special Sensor Cables**

The key to this system is the buried sensor cables. The cables are special coaxial cables often referred to as "ported" or "leaky" cables. This means that radio-frequency signals passing through the cables are emitted into the environment. Conversely, radio-frequency signals in the environment can also be detected by these kinds of cables.

In the Panther system, one cable transmits a radio-frequency signal and the other cable (which runs parallel to the transmitting cable) receives the signal. Any intruder crossing the cables disturbs the signal being received. A microprocessor analyzes the signal to determine if there is an intruder in the detection field.

Sensor Cables and Detection Field



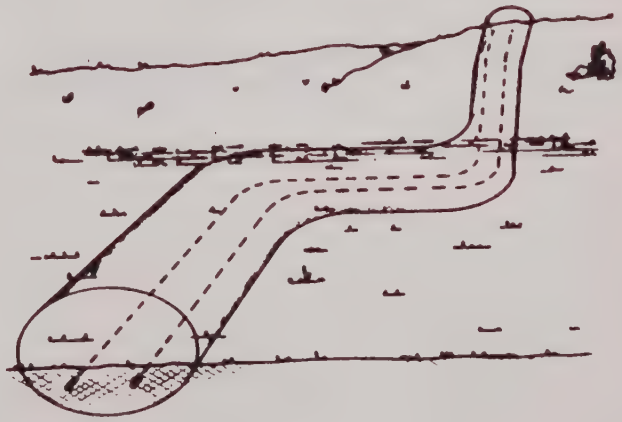
**Intelligent Detection**

Panther's microprocessor uses an adaptive detection methodology; in other words, Panther adjusts itself to changing environmental conditions. Panther provides optimum detection of adult-sized intruders while rejecting false alarms caused by small animals, birds, debris, or other disturbances in the environment.

**Computer Controlled "Radar"**

The process used by Panther is very similar to radar, but there is one important difference: the Panther detection field follows the sensor cables and can be guided around corners and up and down hills. This means Panther isn't restricted to line-of-sight applications.

Detection Field Follows Cables



**Detection Field Shape**

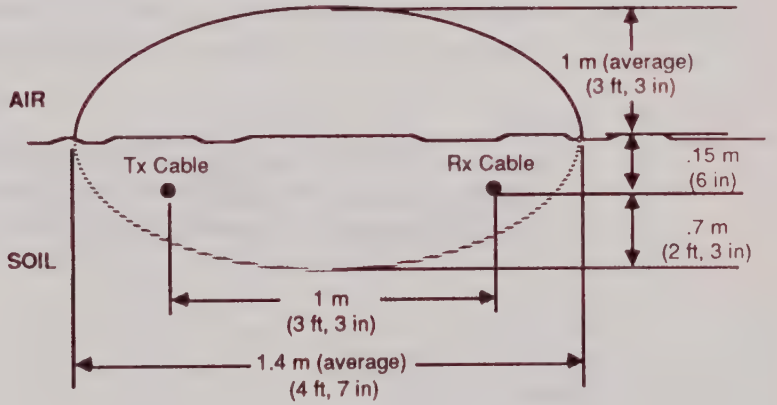
The detection field is the area in which Panther can detect a target. The transmit cable radiates its signals in all directions, and the receive cable is omnidirectional as well. This results in a detection field that is roughly oval in cross-section surrounding both cables.

Panther's detection field is disturbed by any object that has a large enough "electromagnetic cross-section". Metallic and water-filled objects (such as human beings) have large electromagnetic cross-sections and therefore cause a large disturbance of the field. Wooden and plastic objects do not cause a significant disturbance. The size of the disturbance varies depending on the size of the object near the detection field. A truck generates a larger disturbance than a human being, for example.

When a human being crosses the cables, the detection field will be approximately:

- 1 m (3 ft, 3 in) high
- 1.4 m (4 ft, 7 in) wide

Dimensions of Detection Field




* Note - actual field dimensions are dependent on burial medium, cable spacing and sensitivity level.

These dimensions are typical for sensor cables buried in soil and spaced 1 m (3 ft, 3 in) apart.

The field also extends about 0.7 m (2 ft, 3 in) below the cables in the ground, allowing Panther to detect tunnelling attempts.

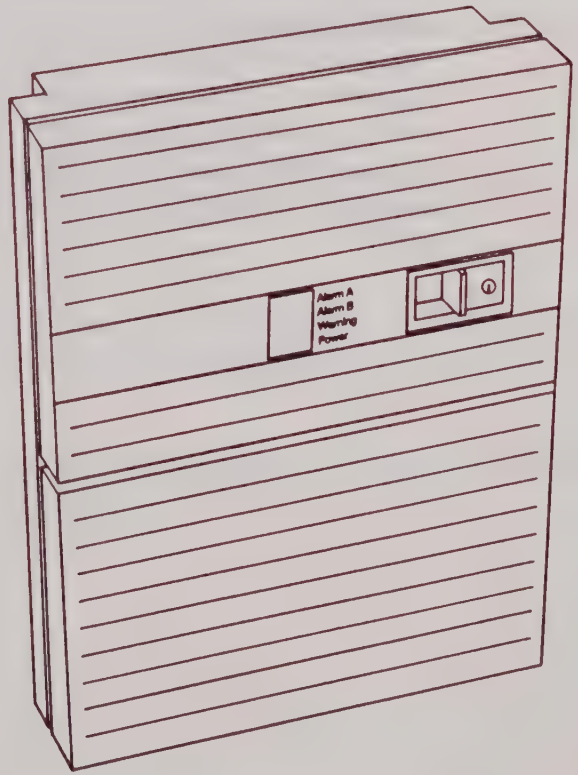
The field is not full-sized in the 4 m (13 ft) field-start section or at the end of the sensor cables past the terminators or decouplers.

You can completely compensate for partial detection in the field-start section by overlapping the field-start sections in the perimeter. See the chapter on Installing the Cables for more information.

## The Detection Unit

The detection unit is an attractive wall-mounted enclosure. It contains the microprocessor electronics and provides connections to the sensor cables and other sensors.

Panther Detection Unit



**What It Does**

The detection unit sends a radio-frequency signal down one cable. This signal creates a detection field which is received by the second cable and sent back to the detection unit. The detection unit microprocessor analyzes the received signal and looks for any disturbances in the detection field caused by an intruder. When an intruder is detected, the detection unit instantly indicates an alarm condition.

Disturbances in the detection field are analyzed by an on-board microprocessor and related software. The microprocessor is programmed to ignore background noise and categorize the disturbances by size; larger targets generate larger disturbances. This is how Panther differentiates between humans and small animals. When you set the sensitivity on Panther, you are telling the microprocessor what size of disturbance is considered to be an intruder.

## Alarm Types

Panther generates two types of alarms:

- sensor
- warning

Sensor alarms are generated whenever someone crosses the cables.

Warning alarms are generated whenever one or more of the following occurs:

- Panther's top door is opened
- the box that houses the Panther enclosure is opened
- fault with the transmit cable
- fault with the receive cable
- sensor failure
- remote input line (Test, Reset or External Tamper) is cut
- input supply voltage is outside the range of 10.2 Vdc - 13.8 Vdc

See the chapter on Troubleshooting and Repair for more information on these alarms.

**What it Needs**

For proper operation, the detection unit requires:

- a 12 Vdc ± 15%, 500 mA power supply (with backup battery, if necessary)
- an alarm panel or annunciator

**Alarm Panels**

If the site you're installing requires alarm processing capabilities, you will have to connect Panther to an alarm panel.

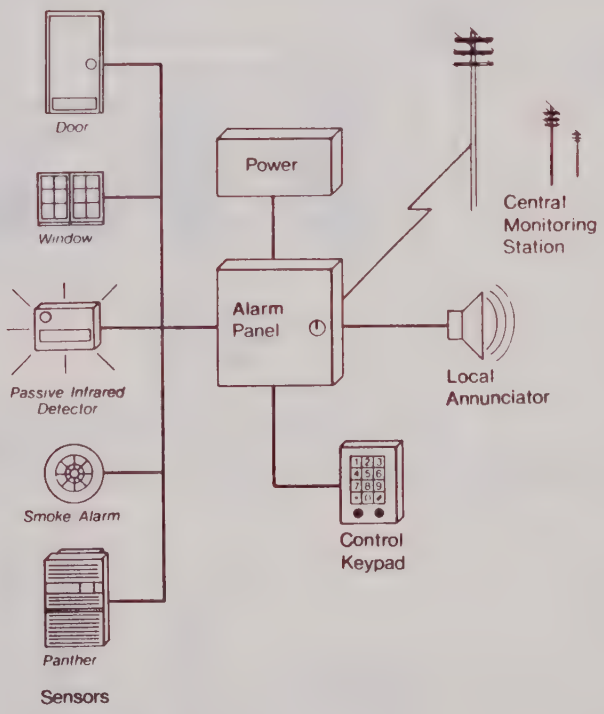
Panther's design allows you to easily connect Panther to a wide variety of alarm panels.

Alarm panels are connected to a terminal strip located inside the detection unit. If an alarm panel requires supervision (end-of-line) resistors, you can plug resistors into special sockets that are also inside the detection unit.

## Other Devices

In addition to the alarm panel, Panther can also work in conjunction with other types of sensors and other devices commonly used in security systems.

### Sensors and Annunciators

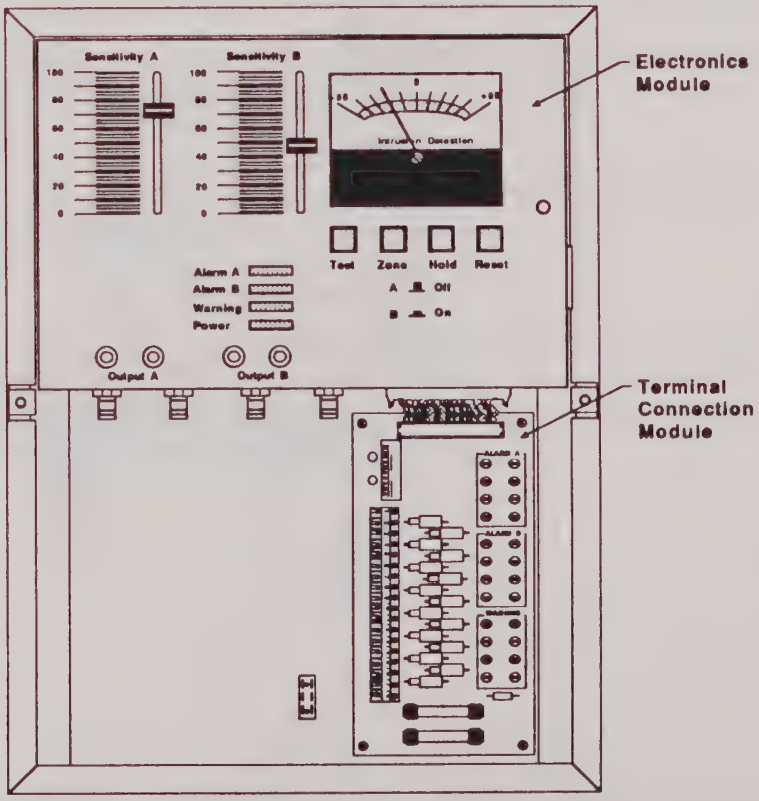


## Modular Design

Panther's detection unit is designed in a way that allows you to easily remove and replace the two major electronic components located inside the metal housing. The two components are:

- the electronics module
- the terminal connection module

Detection Unit Components



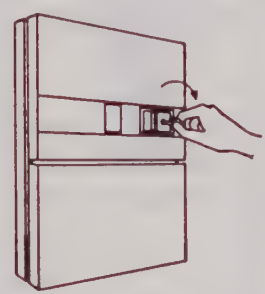

Procedures for removing and replacing these two modules are explained in the Troubleshooting and Repair chapter.

## Accessing the Electronics Module

The detection unit controls are securely hidden behind the top door of the detection unit, in the electronics module. The four indicator lights are visible through a window in the top door. To access the detection unit controls:

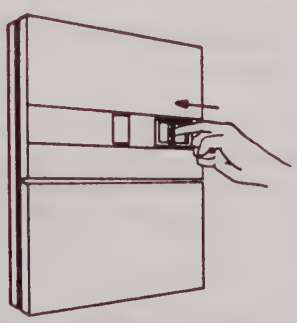
1. Unlock the top door by inserting the key and turning it clockwise. You can remove the key after you turn it.

Unlocking the Door



2. Unlatch the door by sliding the latch to the left. Swing the door open.

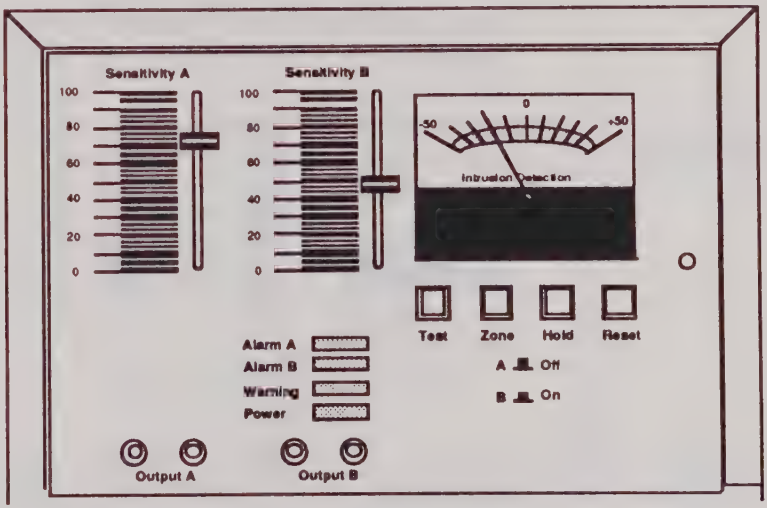
Unlatching the Door



## What the Controls Do

The detection unit controls are designed to make it easy for the installer to set up Panther. The controls and indicators are shown below.

Detection Unit Controls




The purpose of each detection unit control and indicator is listed below.

- **Sensitivity A and B** - let you make the detection field more or less sensitive to intruders. There is one control for each zone.

- **Detection Meter** - indicates intrusions in the zone selected by the Zone switch.

- **Test** - this switch is used to test your alarm system. If you press this switch and the system is operating correctly, the alarm indicators and relays will activate for 3 seconds.

- **Zone A or B** - lets you select which zone is being monitored by the detection meter. When this switch is locked in the "B" position, the detection meter monitors zone B. When this switch is locked in the "A" position, the meter monitors zone A.

- **Hold** - when this switch is locked in the "On" position, the detection meter holds its highest reading. When this switch is in the "Off" position, the detection meter operates normally.

- **Reset** - when this switch is pressed, Panther clears the detection field memory by reducing the signal level to its normal background state.

- **Alarm A and B** - glow red when an intruder enters the corresponding zone.

- **Warning** - glows yellow when Panther's door is opened, or an equipment fault or input line fault is detected. See the section on Alarm Types (page 2-9).

- **Power** - glows green when the power is on and is within the specified range.

- **Output A and B** - allow you to obtain analog signals used for setting up and testing the system. You can connect a chart recorder to these jacks and monitor the sensitivity levels in each zone. See the chapter on Starting Up and Setting Sensitivity for more information.

- **Tamper** (inside hole) - switch that is activated when Panther's door is opened.

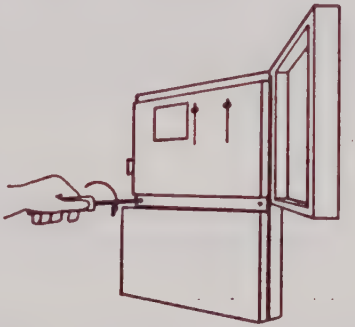
For more information about how to use the detection unit controls, see the chapter on Installing the Detection Unit and the chapter on Starting Up and Setting Sensitivity.

## Accessing the Terminal Connection Module

The bottom door of the detection unit covers the connectors for the sensor cables. It also covers a terminal connection module that allows connection to other equipment, such as an alarm panel. To open the bottom door:

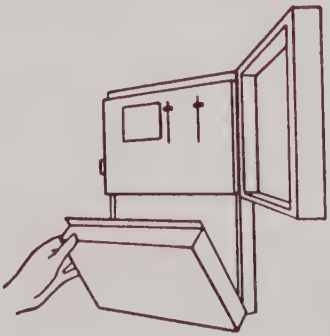
1. Use a standard screwdriver or small coin to turn the screws at the top of the door 1/4 turn counter-clockwise.

Unscrewing Bottom Door



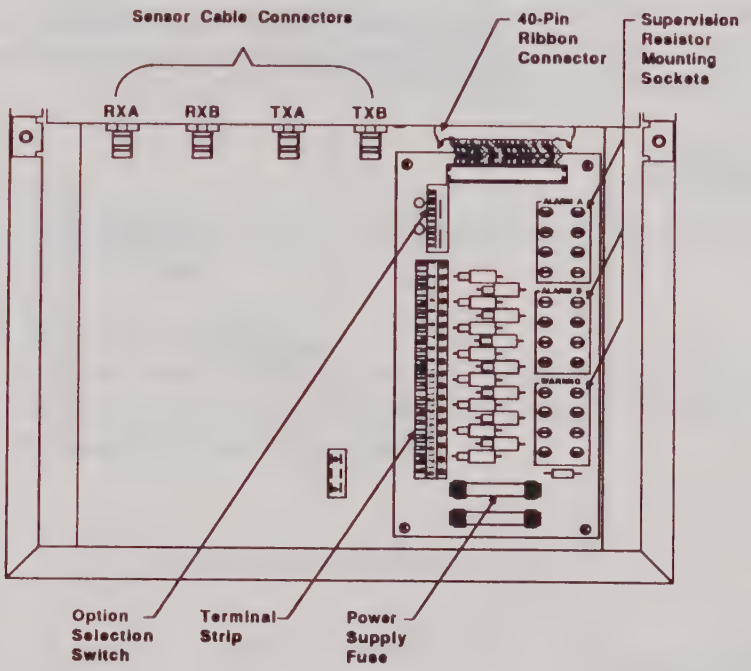
2. Swing the door downwards.

Swinging Door Downwards



The components located in the bottom half of the detection unit are shown below.

Components in Bottom Half of Detection Unit



**What the Connectors and Switches are For**

Each component in the bottom of the detection unit is described below.

- **RXA, RXB, TXA, TXB** - connections to the sensor cables. There is one transmit (Tx) and one receive (Rx) connector for each zone.

- **Terminal Strip** - an eighteen-position terminal strip containing: form C relay outputs for connection to an alarm panel or other device, inputs for 12 Vdc, and inputs for remote control.

- **Supervision Resistor Mounting Sockets** - for alarm panels requiring supervision (end-of-line) resistors.

- **Option Selection Switch (DIP Switch)** - allows you to select the type of analog signal presented at the Output A and B jacks on the front panel. Also allows the installer to select a number of other options (see the section on The Option Selection Switch, in the chapter on Installing the Detection Unit)

- **Power Supply Fuse** - an easily replaceable 3/4 A fast blow 3AG type fuse. A spare fuse is provided on the terminal connection module.

- **Chassis Ground Lug** - an easily detachable ground connection for the Panther detection unit.

For more information about how to use the connectors and switches found at the bottom of the detection unit, see the chapter on Installing the Detection Unit and the chapter on Starting Up and Setting Sensitivity.

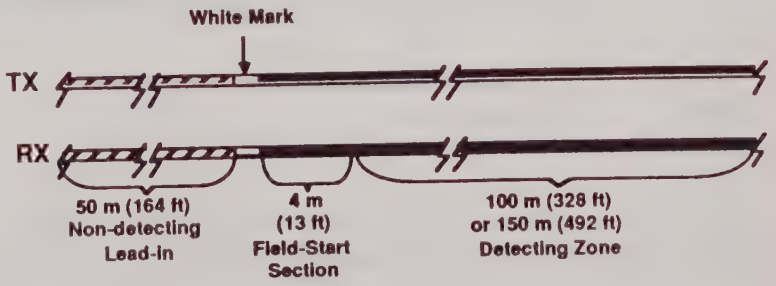
# The Sensor Cables

At first glance, the sensor cables appear to be the same as those used for cable TV wiring. However, each sensor cable has a patented interior construction designed exclusively to work with the Panther alarm electronics. The proprietary design minimizes the number of connections required during installation.

The sensor cables have three different sections:

- a 50 m (164 ft) non-detecting or lead-in cable section
- a 4 m (13 ft) field-start section which has partial detection
- a detecting section which is available in 100 m (328 ft) or 150 m (492 ft) lengths

Sensor Cable Dimensions




There are no physical differences between transmit and receive sensor cables.

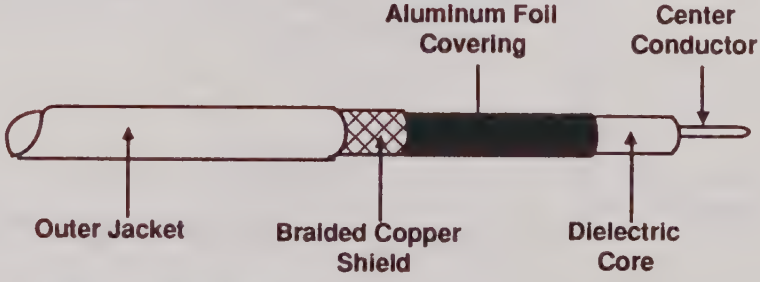
## Non-Detecting Section

The first 50 m (164 ft) of each sensor cable is a non-detecting lead-in section. It's constructed like standard coaxial cable with:

- a center conductor
- surrounding dielectric
- an aluminum foil covering
- a braided shield
- an outer jacket

This section of the sensor cable carries the rf (radio-frequency) signals between the protected zone and the detection unit.

Construction of Lead-in Section



**Detecting Section**

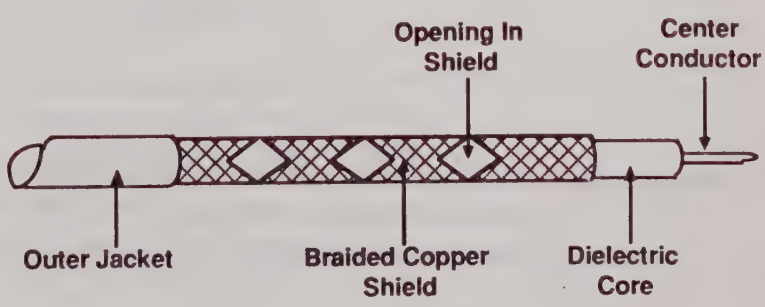
The remainder of the sensor cable is definitely not standard. It has:

- a center conductor
- surrounding dielectric
- no aluminum foil covering
- a "ported" braided shield
- an outer jacket

The shield in the detecting section of the cable is "ported" with diamond-shaped openings and the foil covering is absent, allowing the rf signals to leak out. The design allows the rf signals to radiate from the transmit cable and be detected on the receive cable, which acts like an antenna.

To compensate for losses in the cable, the holes in the shield increase in size as you move away from the non-detecting end. This "grading" of the openings ensures that the detection field will be uniform along the length of the sensor cable.

Construction of Detecting Section

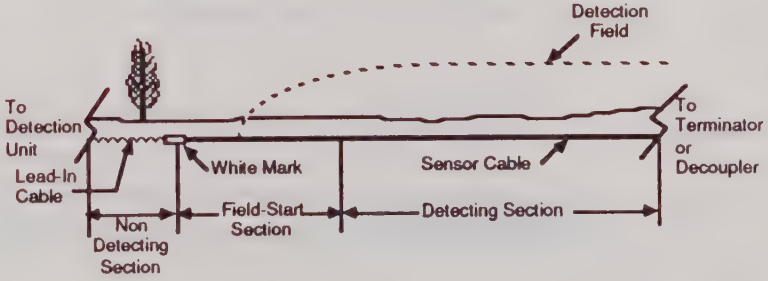


**Field-Start Section**

The first 4 m (13 ft) of the ported section is the "field-start" section. This is the section of the cable where the rf detection field first forms.

Because the detection field is building up to full size in the field-start section, intruders may not be detected in this section. To compensate for the reduced sensitivity, the field-start sections of two zones are overlapped to provide full coverage and to prevent a "low spot" in the detection perimeter. For more information about installing overlaps, see the chapter on Installing the Cables.

Field Start: Detection Field Not at Full Strength




**Ferrite Beads**

To prevent the detection field from straying backwards towards the detection unit, ferrite beads are placed on the non-detecting lead-in cable adjacent to the field-start section.

## Cable Lengths

References to cable lengths are always given for the detecting section only, unless stated otherwise. The detecting section is available in lengths of 100 m and 150 m (328 ft and 492 ft). An extra 4 m (13 ft) of ported cable is supplied to allow for the field-start section. The non-detecting section is only supplied in 50 m (164 ft) lengths.

Although the cables are supplied in standard lengths, they can be cut to any length to suit the requirements of the site.

A 100 m (328 ft) cable has:

- a non-detecting section 50 m (164 ft) long
- a field-start section 4 m (13 ft) long
- a detecting section 100 m (328 ft) long

The total physical length of this cable is 154 m (505 ft).

A 150 m (492 ft) cable has:

- a non-detecting section 50 m (164 ft) long
- a field-start section 4 m (13 ft) long
- a detecting section 150 m (492 ft) long

The total physical length of this cable is 204 m (669 ft).

**Note:** You can cut the lead-in cable to suit the requirements of the site, but you cannot lengthen the cable.

**Cable Markings**

The point on the sensor cable where the non-detecting section joins the ported detecting section is marked by a white ring. This ring is also referred to as the "white mark".

**Cable Packaging**

Sensor cables are shipped from the factory in sets of two. Each of the sensor cables is coiled inside a specially designed cardboard "cable caddy". The cable is dispensed through a hole on the side of the cable caddy. The first 50 m (164 ft) of cable that comes out of the dispenser is non-detecting cable.

You can use either of the cables in the set as transmit cable or receive cable. There are no physical differences between transmit and receive sensor cables.

## Zones and Site Coverage

A zone is a section of the protected perimeter.

Panther can monitor one or two zones, called zone A and zone B. Each zone can have a length of up to 150 m (492 ft). The total monitored perimeter can be up to 300 m (984 ft) long.

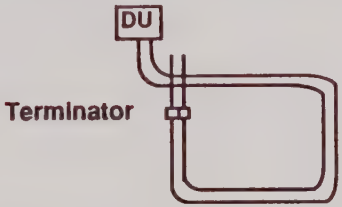
## Closed Loop

The monitored perimeter is usually a closed loop that surrounds the area to be protected. Since Panther can monitor two zones, it can protect two different areas with closed loops.

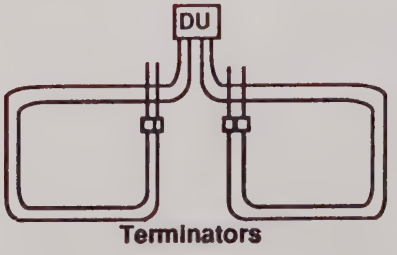
In closed-loop configurations, the cables cross over themselves to form an enclosed area. You can use closed loops on sites where a perimeter is small enough to be covered by one zone, or where two small perimeters are required.

Terminators are attached to the sensor cables at the end of each zone to stop the detection field.

Single Zone, Closed Loop



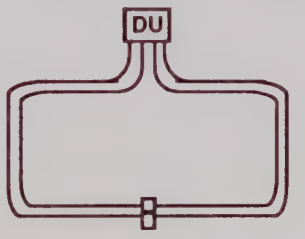

Two Zones, Closed Loop



## Decoupled Loop

Long perimeters can be surrounded by joining the ends of the sensor cables in zone A to the ends of the sensor cables in zone B. Devices called decouplers are used to join the ends of the sensor cables together. The decoupler stops the detection field at the end of each zone. This type of closed loop is called a Two-Zone, Decoupled system.

Two Zones, Decoupled Loop



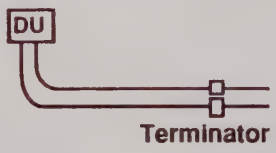

**Decoupler**

## Open Loop

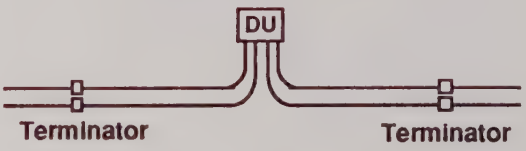
Open loops are used on sites where the protected area doesn't need to be surrounded. In an open-loop configuration, the sensor cables aren't crossed or joined.

The sensor cables are placed in a partial loop around the site, protecting the most vulnerable approach path. The two zones can even be used to protect two different areas. In order to stop the detection field, terminators are attached to the sensor cables at the end of each zone.

Single Zone, Open Loop




Two Zones, Open Loop




For information on applications that require more than two zones or that have a perimeter length greater than 300 m (984 ft), contact your Panther distributor.

# Getting Ready

# Getting Ready


| | |
|---|---|
| Trouble-Free Installations | 3-1 |
| The Six Steps to Success | 3-4 |
| Checking the Site Plan | 3-15 |
| Parts You Will Need | 3-17 |
| Tools and Materials You Will Need | 3-19 |

# Trouble-Free Installations

**The Golden Rule: Make Good Connections**

As an installer, your major concern is that all sensor cable connectors and terminators/decouplers are installed correctly. THIS CAN NOT BE OVER-EMPHASIZED. System reliability depends directly on good sensor cable connections. Most problems can be traced to poorly installed connectors. Avoid callbacks! Follow the recommended procedures.

Detailed procedures for installing connectors, terminators and decouplers are included in the chapter on Installing the Cable Fittings. Read that chapter before you install your first system and make sure you practise the procedures. Bring this handbook with you when you install a system so you can refer to the procedures during installation.

## Guiding Principles

All trouble-free Panther systems have two things in common: proper design and correctly installed sensor cables. Customer satisfaction requires well-designed cable routing and adherence to six simple rules. These Six Steps to Success will:

- reduce installation time
- reduce the cost of installation
- ensure that the system works well

The Six Steps to Success are:

1. Measure Carefully
2. Bury in a Single Medium (Soil if Possible)
3. Bury at Proper Depth
4. Keep Cable Spacing Constant
5. Make Gradual Turns
6. Avoid Obstructions

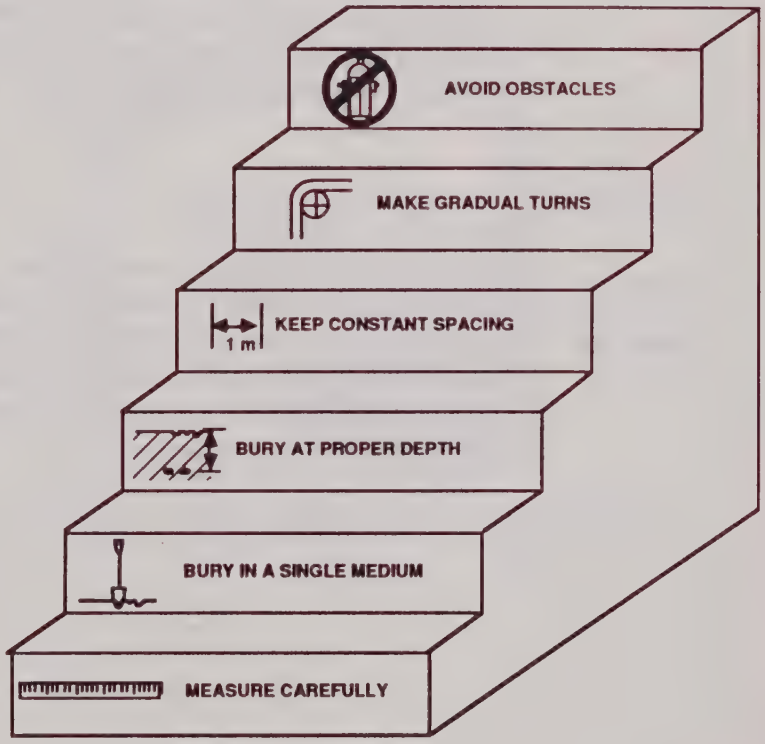
The Six Steps to Success can be summarized into one guiding principle:

- Keep zones uniform.

Within each zone there are many variables: burial depth, medium, spacing, and so on. Although Panther is adaptable enough to use in almost any situation, there are limits beyond which the performance begins to deteriorate. The Six Steps to Success represent the most critical aspects for good performance. If you follow the Six Steps, you shouldn't encounter problems.

The site plan designer uses the guidelines given in the Six Steps to Success to route the sensor cables and place the terminators or decouplers. You should review the steps in order to understand some of the design decisions.

Six Steps to Success



## The Six Steps to Success

**1. Measure Carefully**

The measurements taken during the site survey have been used to estimate the materials and labor required to do the installation. Careful measurements are necessary if you're to have the correct quantities on hand during installation. Where outside contractors are going to perform some of the work, such as cable burial, they will use your measurements to provide an estimate.

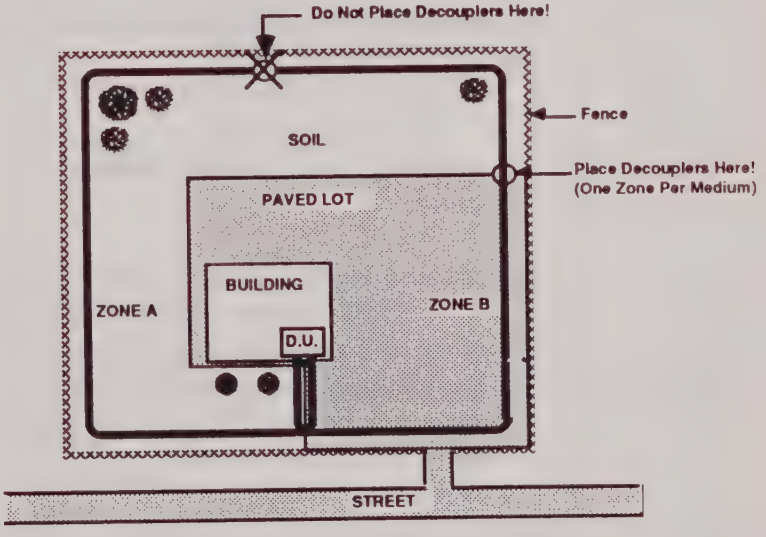
**2. Bury In a Single Medium**

Burial in soil is both the easiest and least expensive method of installing sensor cables. Where possible, route the cables so they are in soil. If it's necessary to bury the sensor cables in more than one medium, try to keep each zone in a single medium. This allows you to optimize the sensitivity of each zone for each burial medium.

An example of a site that has more than one medium is shown below. The site has a 200 m (656 ft) perimeter consisting of:

- 150 m (492 ft) of soil
- 50 m (164 ft) of asphalt

One Zone Per Medium



If you use two 100 m (328 ft) zones for this site, one zone will straddle two different mediums. To avoid this problem:

- Make one zone 150 m (492 ft) long (in the soil).
- Make the other zone 50 m (164 ft) long (in the asphalt).
- Put the decouplers at the soil/asphalt boundary.

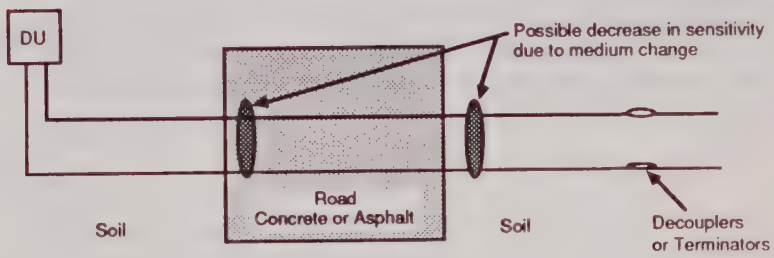
In some cases it may not be possible to have each zone in a single medium.

If a zone crosses two (or more) mediums, the following problems can occur:

1. Because different mediums have different sensitivities (e.g., concrete has a higher sensitivity than soil), it might be difficult to establish a proper sensitivity level. If you set the sensitivity level for concrete, it might be too low to detect disturbances in the soil portion. If you set the sensitivity level for soil, it might be too high for the concrete portion, causing alarms to be generated for small animals as well as humans.

2. There might be a sharp decrease in sensitivity in the areas just past the transition points.

Areas of Decreased Sensitivity




If you must have a zone cross two (or more) mediums, the rules in step 3, Bury at Proper Depth, will allow you to compensate for the changes in sensitivity.

The type of medium also determines how far away you must place the cables from metallic objects. For more details see the tables on page 5-42 and 5-43 in the chapter called Laying Out the Cable Route.

### 3. Bury at Proper Depth

The recommended burial depth depends on the medium:

Burial Depths in Various Mediums

| Medium | Burial Depth |
|---|---|
| soil* | 15 cm (6 in) |
| gravel | 23 cm (9 in) |
| asphalt/concrete | 3.2 cm (1.25 in) |

* For areas with heavy vehicular traffic, burial depth should be 23 cm (9 in). This is purely to prevent mechanical damage to the cable.

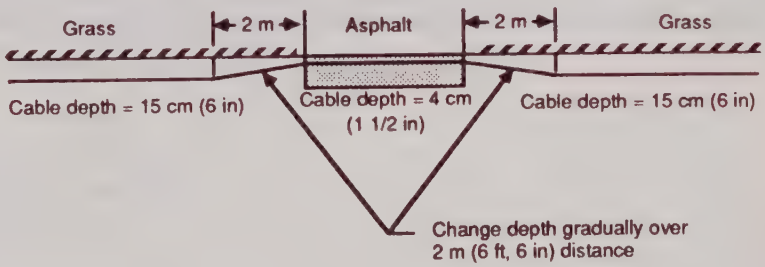
Panther's sensitivity is higher where the sensor cables are buried in or under asphalt or concrete. To compensate for this effect, you can bury the cables deeper in these mediums. The burial depth must change at the transition from one medium to another. The least desirable transition is from a slot cut in pavement to any other medium. Avoid such transitions within one zone by placing the decouplers at the medium boundary.

If you must have a zone cross more than one medium, try to:

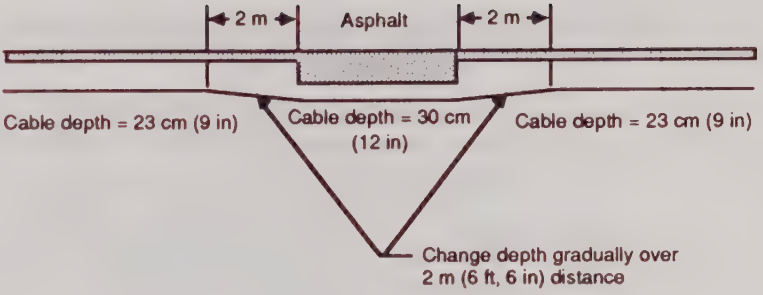
1. Bury the sensor cables in soil beneath the pavement, instead of in slots in the pavement. The difference in sensitivity between cables buried in soil and cables buried under pavement is somewhat less than the difference between cables buried in soil and those placed in slots in the pavement. The less of a difference in sensitivity, the easier you'll find it to set the sensitivity level.

2. Make the transitions gradual.

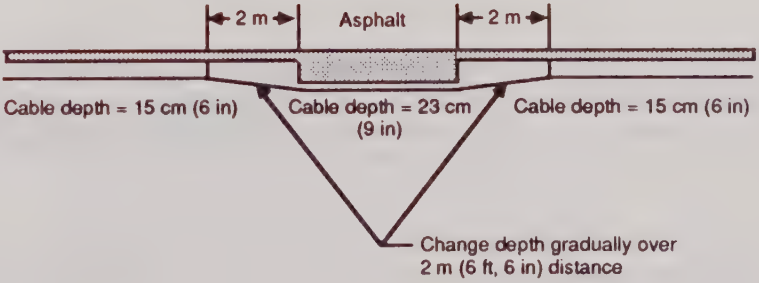
Gradual Transition from Soil to Pavement



Gradual Transition from 9 to 12 in. in Asphalt


2 m
Asphalt
2 m
Cable depth = 23 cm (9 in)
Cable depth = 30 cm (12 in)
Cable depth = 23 cm (9 in)
Change depth gradually over 2 m (6 ft, 6 in) distance

Gradual Transition from 6 to 9 in. in Asphalt


2 m
Asphalt
2 m
Cable depth = 15 cm (6 in)
Cable depth = 23 cm (9 in)
Cable depth = 15 cm (6 in)
Change depth gradually over 2 m (6 ft, 6 in) distance

**4. Keep Cable Spacing Constant**

The two sensor cables run parallel to each other around the protected perimeter. The cables must be at least 1 m (3 ft, 3 in) apart at all points, including curves. Altering the spacing can adversely affect the sensitivity.

Wider cable spacing is permitted for parking lot applications where vehicles are parked directly over the cables. The cables can be either:

- 1 m (3 ft, 3 in) apart (one row of cars)
- 2 m (6 ft, 6 in) apart (two rows of cars)

You can use the spacing which provides the best coverage. Spacing must be constant within one zone, but two zones can have different spacings if required.

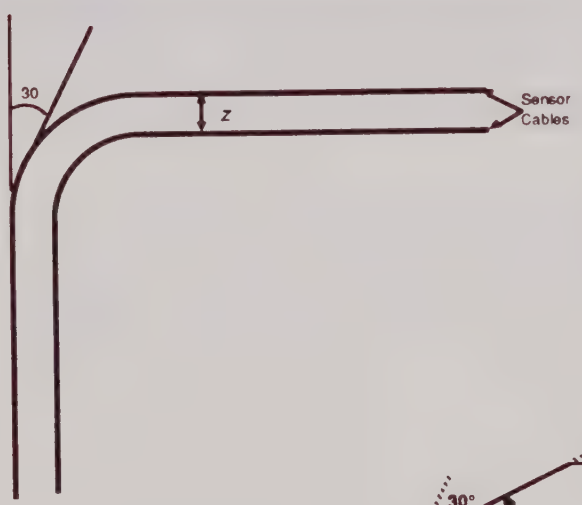
**5. Make Gradual Turns**

The sensor cables can follow almost any path, but must not be turned too sharply. Normally, the detection field follows the cable path. But at a sharp turn the detection field can "swing wide" the same way a car will skid outwards on a sharp curve.

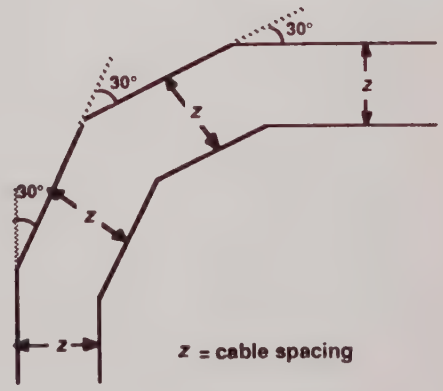
To minimize this effect:

- follow a smooth curve, not exceeding 30°, when turning in a soft medium such as soil or gravel
- make 90° turns using three successive 30° turns when turning in a hard medium such as concrete or asphalt

Smooth Curve




30° Turns




The detection field can be distorted by steep slopes the same way it can be distorted by sharp turns. Limit the change in grade of the cables to 30° or less.

**6. Avoid Obstacles**

Keep both sensor cables away from obstacles such as:

- buildings
- metal fences or other metal objects
- standing water (ponds, ditches, or poorly drained areas)

See the chapter on Laying Out the Cable Route for the recommended separation distances from these and other objects.

## Checking the Site Plan

**Check the Design**

When you see the site plan for the first time, check the design of the system against the guidelines given in the Six Steps to Success. If you see parts of the design that can be improved, mark the changes on the site plan for future reference. Sometimes the guidelines have to be broken because of the nature of the site. However, you must follow the guidelines wherever possible.

It's quite possible that the Panther system originally designed for the site you are installing can now be installed at a lower cost by using newer components or techniques. Make sure you're using the most up-to-date methods available.

**Use Your Experience**

Although you might have the best sales and design force in the industry, they're not "down in the trenches" installing the equipment. You may be able to make design changes that improve system performance or reduce installation costs. Let your designers know when you've changed their design so they can adjust their practices.

**Look for Errors**

People make mistakes. If you can spot design or specification errors before you get to the customer's site, you can save your company money and embarrassment.

# Parts You Will Need

## Single-Zone System

| | |
|---|---|
| ☐one Panther detection unit | Order #: OI-200051-01 |
| ☐one load set | Order #: OI-200066-01 |
| ☐one terminator set | Order #: OI-200065-01 |
| one of the following: | |
| ☐set of sensor cables, 100 m (328 ft) | Order #: OI-200052-01 |
| ☐set of sensor cables, 150 m (492 ft) | Order #: OI-200052-02 |

## Two-Zone System

| | |
|---|---|
| ☐one Panther detection unit | Order #: OI-200051-01 |
| ☐for zone A: | |
| ☐one terminator set | Order #: OI-200065-01 |
| one of the following: | |
| ☐set of sensor cables, 100 m (328 ft) | Order #: OI-200052-01 |
| ☐set of sensor cables, 150 m (492 ft) | Order #: OI-200052-02 |
| ☐for zone B: | |
| ☐one terminator set | Order #: OI-200065-01 |
| one of the following: | |
| ☐set of sensor cables, 100 m (328 ft) | Order #: OI-200052-01 |
| ☐set of sensor cables, 150 m (492 ft) | Order #: OI-200052-02 |

## Two-Zone, Decoupled System

| | | |
|---|---|---|
| ☐ one Panther detection unit | Order #: | OI-200051-01 |
| ☐ one decoupler set | Order #: | OI-200064-01 |
| ☐ for zone A, one of the following: | | |
| ☐ set of sensor cables, 100 m (328 ft) | Order #: | OI-200052-01 |
| ☐ set of sensor cables, 150 m (492 ft) | Order #: | OI-200052-02 |
| ☐ for zone B, one of the following: | | |
| ☐ set of sensor cables, 100 m (328 ft) | Order #: | OI-200052-01 |
| ☐ set of sensor cables, 150 m (492 ft) | Order #: | OI-200052-02 |

## Spare Parts and Accessories

| | | |
|---|---|---|
| ☐ single sensor cable, 100 m (328 ft) | Order #: | SP-100044-00 |
| ☐ single sensor cable, 150 m (492 ft) | Order #: | SP-100045-00 |
| ☐ non-detecting cable (specify length in meters) | Order #: | SP-100022-00 |
| ☐ splice kit | Order #: | OI-200068-01 |
| ☐ ferrite bead kit (package of 10) | Order #: | OI-200069-01 |
| ☐ load | Order #: | EM-200526-00 |
| ☐ male connector | Order #: | T0381 |
| ☐ female connector | Order #: | T0380 |
| ☐ female to female adapter | Order #: | T0395 |
| ☐ shrink tubing kit | Order #: | OI-200070-01 |
| ☐ cable identification label | Order #: | SP-100051-00 |
| ☐ decoupler | Order #: | EM-200524-01 |
| ☐ terminator | Order #: | EM-200525-00 |
| ☐ Panther cable stripping tool | Order #: | MD-100415-00 |
| ☐ Replacement blade cassette for Panther stripping tool | Order #: | T0400 |
| ☐ Panther crimping tool | Order #: | T0378 |
| ☐ TNC/Banana plug adapter cable | Order #: | CD-200940-00 |
| ☐ spare electronics module | Order #: | EM-200508-00 |
| ☐ spare terminal connection module | Order #: | BA-200200-00 |

# Tools and Materials You Will Need

## Standard Tools

- ☐ Panther cable stripping tool
- ☐ Panther crimping tool
- ☐ electronic toolkit (side cutters, needle-nose pliers, screwdriver, etc.)
- ☐ ohmmeter
- ☐ chart recorder
- ☐ electric drill (may be necessary for mounting detection unit)
- ☐ extension cord
- ☐ Panther Installer's Checklist (you will find one at the back of this handbook)
- ☐ this handbook

## Cable Burial Tools

Note that some items (*) are needed only for asphalt or concrete burial.

- ☐ cable burial marker stakes
- ☐ fluorescent marker paint
- ☐ chalk line
- ☐ shovel
- ☐ rake
- ☐ trenching machine
- ☐ sod slitter or remover
- ☐ concrete saw*
- ☐ sand
- ☐ pavement sealant (Dow Corning 888, 3M Traffic Loop Sealant)*

If cable burial is being performed by an outside contractor, you may wish to check the specifications for burial. Schedule your work in a way that allows you to perform a quick test of the system BEFORE the cables are permanently buried.

**Damp Weather Tools**

**WARNING!** - all sensor cable connections must be absolutely dry. Trapped moisture leads to corrosion and system failure. Avoid damp weather installations. If you must install the sensor cables in damp conditions you will need:

☐heat gun/radiant heater
☐extension cord
☐propane heater/dryer (if no power is available)

# Installing the Cable Fittings

# Installing the Cable Fittings


Installing Connectors 4-1
Installing Terminators and Decouplers 4-15

# Installing Connectors

System reliability depends directly on proper connections. Most problems can be traced to poorly installed connectors. Avoid call-backs! Follow the recommended procedures.

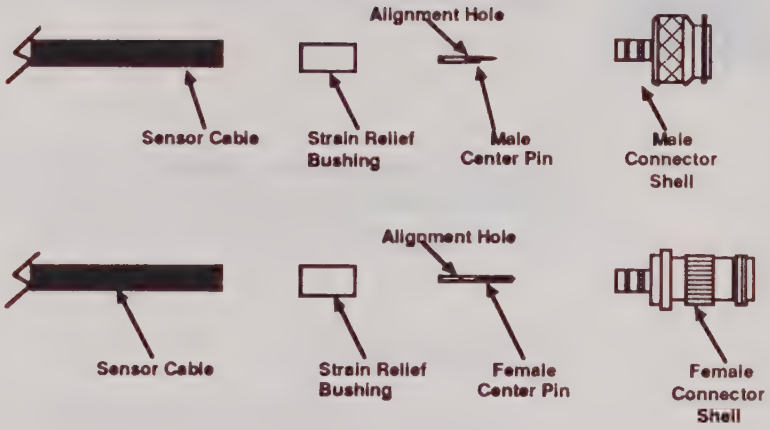
Connectors are used to:

- join the sensor cables to the detection unit
- attach terminators to sensor cables
- attach decouplers to sensor cables
- make splices

The TNC connectors supplied with Panther have been specially designed to work with the sensor cable. Do not substitute any other connectors. If you do, system performance will be seriously affected.

The installation procedure is the same for both male and female connectors even though the head shells and center pins are different.

Connector Parts



**Key Points**

Note the following:

- **All connections must be dry**. Trapped moisture can cause corrosion, reduced performance, and system failure. Use a heat gun to remove any moisture.
- Do not drop or place the connectors, cable ends, terminators, or decouplers on the ground or allow them to get wet or dirty.
- Do not put connectors on the cables until just before you connect them to the detection unit, decoupler, or terminator.
- Use the Panther cable stripping tool to ensure proper strip length and to avoid damaging the cable. If the blade is dull, turn it over or replace it.
- Use the Panther crimp tool to ensure proper crimping of connectors to the sensor cable.
- Do not use the Panther crimp tool on other connectors; you may damage the tool.

If the connectors are used for cable splicing or repair, they must be made completely waterproof. See the Troubleshooting and Repair chapter for details.

**Tools and Materials**

- Panther TNC connector
- one nylon "zip-tie"
- Panther crimp tool
- Panther coaxial cable stripping tool
- replacement blades for cable stripping tool (if necessary)
- side cutters
- heat gun with extension cord (in damp locations)
- ohmmeter
- TNC female to female adapter
- TNC/Banana plug adapter cable

**Connector Installation Procedure**

1. Examine the connector package and make sure it contains:

   - connector body or "headshell" (male or female)
   - connector center pin (male or female)
   - strain relief bushing

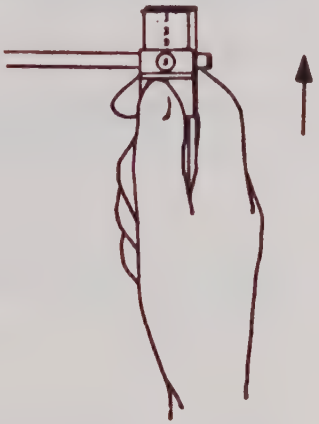
2. The end of the cable may be roughly trimmed. Cleanly cut off the end of the cable with side cutters.

3. Fasten the nylon tie about 0.5 m (1 ft, 8 in) along the cable. It will keep the strain relief bushing from sliding down the cable into the dirt.

4. Slide the strain relief bushing onto the cable.

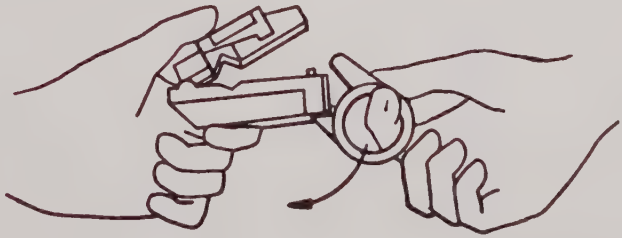
5. Set the stripping tool so that the number 5 is showing in the window.

Setting Stripping Tool at Number 5



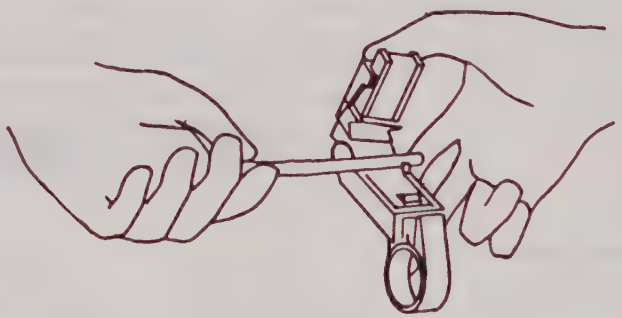
6. Open the stripping tool by pulling down the ring at the end of the tool as shown below.

Pulling Down Ring



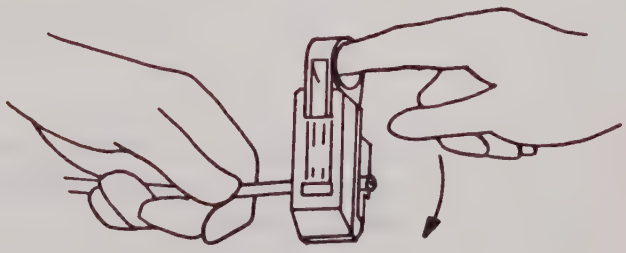
7. Hold the cable in your left hand and clamp the cable stripping tool onto the cable about 6 mm (1/4 in) from the end of the cable as shown below.

Clamping Tool onto Cable



8. Rotate the tool several times so the knives can make their cuts.

Rotating Tool to Cut Cable



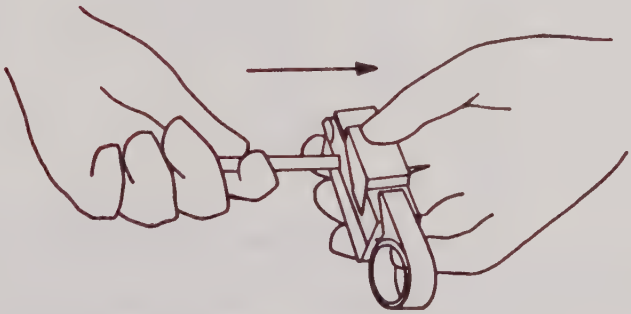
If you are stripping 'leaky' (detecting) cable, follow steps 9 to 11. If you are stripping non-detecting cable, leave the tool closed and pull it off the end of the cable. Then go to step 12.

9. Slide the depth selector up on the stripping tool so that the number 4 is showing in the window.

10. Rotate the tool several times again.

11. Slide the depth selector down on the stripping tool so that the number 5 is showing in the window. Leave the tool closed and pull it off the end of the cable.

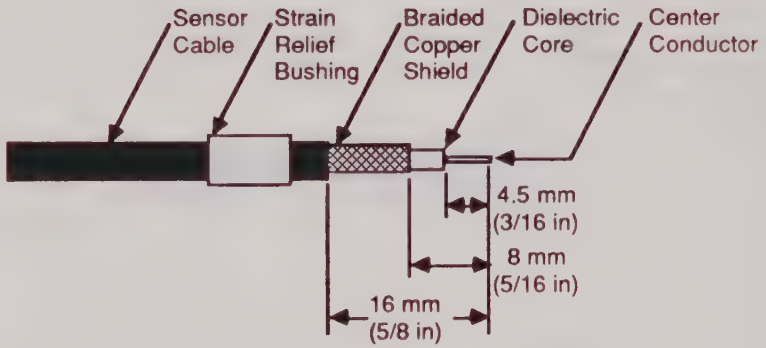
Pulling Tool off End of Cable



12. If the cable is not cleanly cut, turn the stripping tool blade cassette over or replace it. Cut the cable again, following the above procedures.

13. Trim the center conductor with side cutters so that 4.5 mm (3/16 in) of the center conductor is exposed.

Center Conductor Exposed




14. If foil covers the dielectric core, ensure that the foil does not short to the center conductor. You may remove all of the exposed foil covering if you wish.

15. Slide the center pin onto the center conductor until it butts against the dielectric core. Look through the small hole in the side of the pin. The center conductor should be visible in the alignment hole.

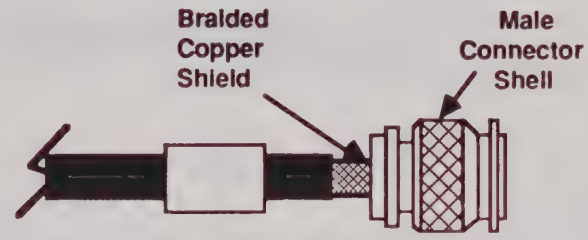
Location of Pin and Alignment Hole

16. If the end of the cable is straight and the pin is in the right position, crimp it in place with the crimp tool. Use the small square hole of the crimp tool and crimp as close as possible to the dielectric core. WARNING: the crimp tool is rachet-driven and must travel a full stroke before it will release - careless operation can result in personal injury!

17. Check the center pin. It must be solidly attached. If it wiggles, remove it, restrip the cable and start from step 15. DO NOT solder the pin! If you solder, the dielectric will expand and prevent proper assembly.

18. Slide the connector headshell onto the end of the cable over the dielectric core and beneath the copper braid.

Sliding Headshell onto Cable




You should feel the headshell engaging the center pin - it should snap into place.

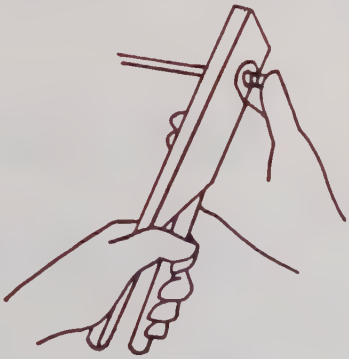
19. Smooth the copper braid towards the headshell.

20. Slide the strain relief bushing up the cable until it rests against the back surface of the headshell.

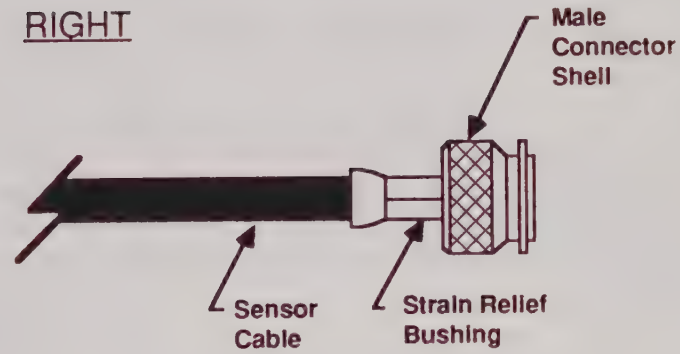
21. Place the crimp tool against the back of the headshell and crimp the strain relief bushing to the cable using the large hexagonal hole of the crimp tool. Hold your thumb against the headshell to ensure that the headshell doesn't slide away from the bushing during crimping.

    **Note:** Ensure that the bushing is crimped **directly beside** the male connector.

Crimping Strain Relief Bushing

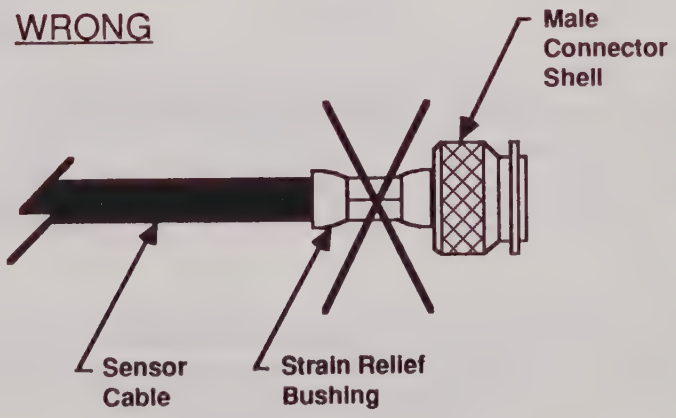


Right - Strain Relief Bushing Crimped to Headshell




* Note - ensure bushing is crimped directly beside male connector.

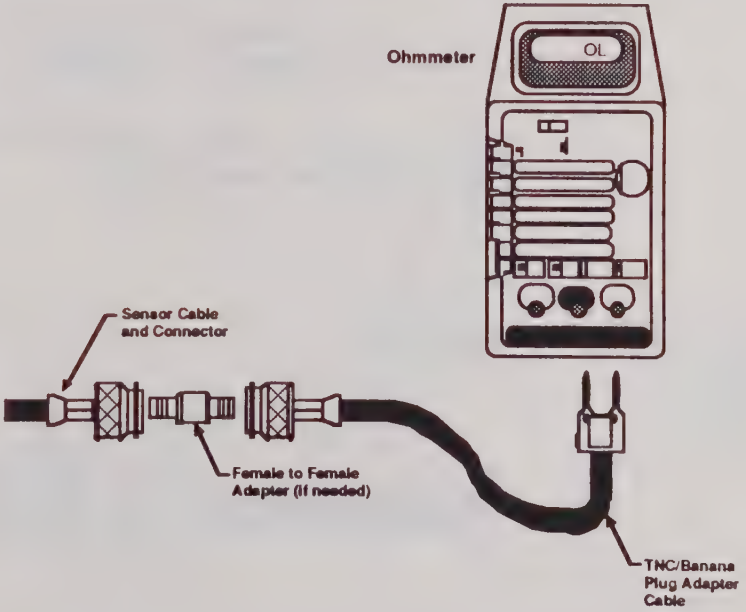
Wrong - Strain Relief Bushing Not Crimped to Headshell



22. Make sure the center pin is not shorted against the headshell on the connector. Attach the TNC/Banana plug adapter to the connector (use the TNC female to female adapter if necessary). Attach an ohmmeter to the banana plugs and check for intermittent shorts by wiggling the connector.

    If you do find a short, restrip the cable and install a new connector.

Testing for Shorts




23. Place the appropriate label on the cable near the connector. Apply the printed portion of the label first so that the clear portion ends up covering it.

24. If this is an underground connection, see the Troubleshooting and Repair chapter for instructions on waterproofing connectors.

## Installing Terminators and Decouplers

Installing terminators and decouplers is fast and very easy. Terminators and decouplers are simply attached to male connectors fastened to the sensor cables. The terminators and decouplers are then covered with Panther shrink tubing to waterproof the connections.

Panther terminators and decouplers have 130 kΩ supervision resistors built into them. Panther's detection electronics look for this resistance in order to monitor the sensor cables for failure or sabotage. You don't have to supply any extra components for this built-in feature.

Terminators, decouplers, and the detection unit sensor cable inputs all contain components that can be damaged by voltages above 150 Vdc. DO NOT use any high-voltage cable-leakage testers (or "Meggers") on the sensor cables unless the terminators, decouplers, and detection unit have been disconnected.

System reliability depends directly on proper connections. Most problems can be traced to poorly installed connectors. Avoid callbacks! Follow the recommended procedures.

Terminator

A terminator consists of:

- a cylindrical tube 7 cm (2 3/4 in) long and 1.5 cm (5/8 in) in diameter enclosing an electronic circuit
- an integral female Panther TNC connector on one end of the tube
- an integral 4 m (13 ft) stub of cable on the other end of the tube

**What it Does**

Terminators are attached to the ends of sensor cables to:

- provide a supervision resistor for the sensor cables
- provide rf termination for the sensor cables
- allow the detection field to dissipate in a controlled manner (the field follows the path of the cable stub)

Decoupler

A decoupler consists of:

- a cylindrical tube 7 cm (2 3/4 in) long and 1.5 cm (5/8 in) in diameter enclosing an electronic circuit
- an integral female Panther TNC connector on each end of the tube

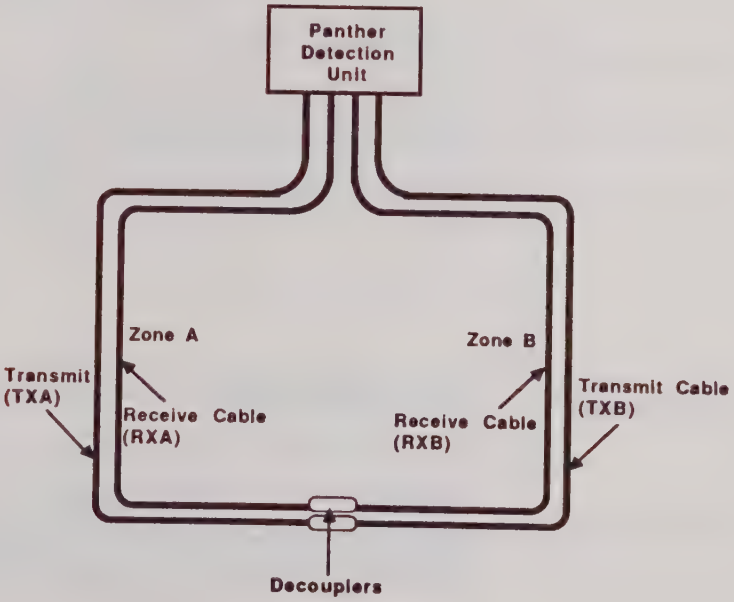
**What It Does**

The decouplers are attached to the ends of sensor cables of each zone to:

- join the ends of two zones together
- provide supervision resistors for the sensor cables
- provide rf termination for the sensor cables
- allow the detection fields for each zone to dissipate while providing full coverage at the zone boundary

If you're using two zones to completely surround one area, you should use two decouplers to join the ends of the sensor cables in one zone to the ends of the sensor cables in the other zone. The transmit and receive cables of each zone are connected together using decouplers.

Joining Two Zones with Decouplers



**Key Points**

Note the following:

- **All connections must be dry**. Trapped moisture can cause corrosion, reduced performance, and system failure. Use a heat gun to remove any moisture.
- Do not drop or place the connectors, cable ends, terminators, or decouplers on the ground or allow them to get wet or dirty.
- Do not put connectors on the cables until just before you connect them to the detection unit, decoupler, or terminator.
- Use the Panther cable stripping tool to ensure proper strip length and to avoid damaging the cable. If the blade is dull, turn it over or replace it.
- Use the Panther crimp tool to ensure proper crimping of connectors to the sensor cable.
- Do not use the Panther crimp tool on other connectors; you may damage the tool.

Since decouplers and terminators are always buried, they must be made completely waterproof.

- Use an ohmmeter to do a continuity check prior to waterproofing.
- Use the approved Panther shrink tubing.

**Tools and Materials**

Whenever you install terminators or decouplers, you will need the following:

- Panther terminator or decoupler kit which includes:
  - two terminators or decouplers
  - two pieces of Panther shrink tubing
  - one roll of putty tape
  - one cable preparation kit
- male Panther TNC connectors (1 for terminators, 2 for decouplers)
- Panther crimp tool
- Panther cable stripping tool
- side cutters
- heat gun with extension cord (in damp locations)
- ohmmeter
- TNC female to female adapter
- TNC/Banana plug adapter cable
- knife or scissors

**Terminator Installation Procedure**

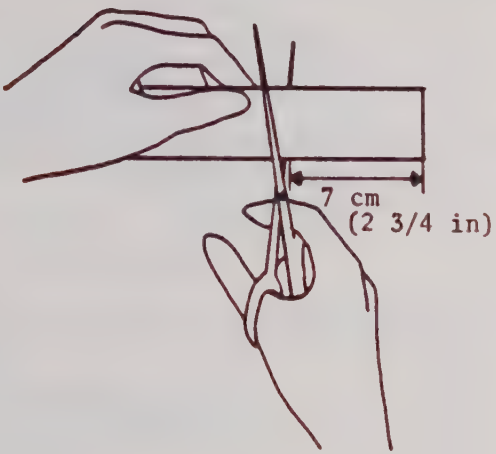
1. Install a male Panther TNC connector on one sensor cable. Use the procedure given in the Installing Connectors section of this chapter.

2. Rub the cable with the sandpaper from the cable preparation kit and wipe the cable with the supplied cleaning cloth. This roughens and cleans the cable surface for a good bond to the putty tape. Also prepare the cable stub that comes out of the terminator body.

Wiping Cable

3. Cut two 7 cm (2 3/4 in) strips of putty tape.

Cutting Tape




4. Place one piece of putty tape lengthwise along the cable flush against the connector headshell. The distance from the back of the headshell to the end of the tape should be 7 cm (2 3/4 in).

5. Mold the tape around the cable.

Molding Tape Around Cable

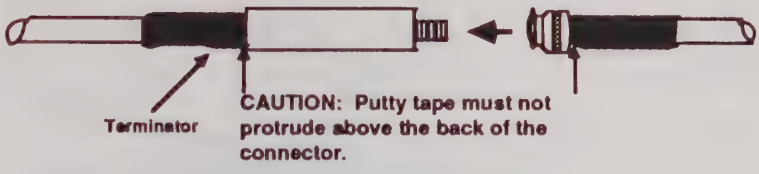
6. Place the other piece of putty tape lengthwise along the cable stub and flush against the back of the terminator body.

7. Mold the tape around the cable.

8. Slide the shrink tubing onto the cable so that the long plastic strip inside the tubing trails out toward the connector.

9. Connect the terminator to the male connector.

Connecting Terminator to Male Connector



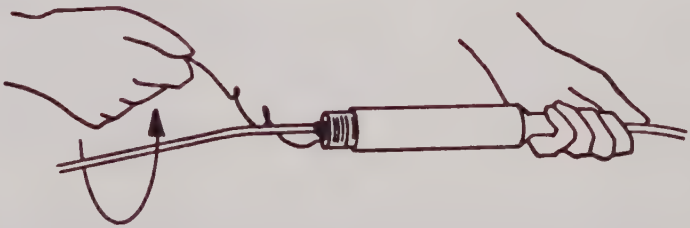

10. Use an ohmmeter to test the sensor cable connection. To do this you must be at the detection unit. Disconnect the sensor cables and measure the resistance. You should detect the 130 kΩ supervision resistor in the terminator.

11. Hold the shrink tubing over the terminator so that 0.5 - 1 cm (1/4 - 1/2 in) of the putty tape on the connector cable is exposed.

12. Collapse the shrink tubing around the terminator by pulling and unwinding the plastic tape wound inside the tubing, in a counter-clockwise direction. **Unwind the plastic tape using a spiral motion to avoid wrapping it around the cable or the putty tape.** Failure to follow this procedure could result in the plastic tape becoming entangled in the putty tape. If this happens, remove the tubing, and repeat the procedure from step 11 with a new piece of shrink tubing.

    Make sure you collapse the tubing so that 0.5 - 1 cm (1/4 - 1/2 in) of the end of the putty tape on the connector cable is exposed. The shrink tubing lengthens as it collapses and should center over the terminator.

Collapsing Shrink Tubing



13. Repeat the procedure for the other cable.

**Decoupler Installation Procedure**

1. Install a male Panther TNC connector on one sensor cable. Use the procedure given in the Installing Connectors section of this chapter.

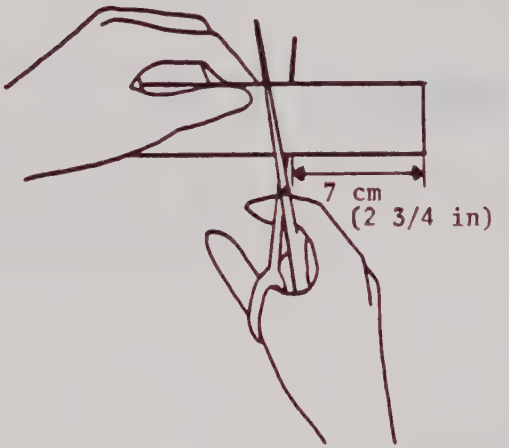
2. Install a male Panther TNC connector on the corresponding cable (transmit or receive cable) for the other zone.

3. Rub 8 cm (3 in) of each cable with the sandpaper from the cable preparation kit and wipe the cables with the supplied cleaning cloth. This roughens and cleans the cable surface for a good bond to the putty tape.

Wiping Cable

4. Cut two 7 cm (2 3/4 in) strips of putty tape.

Cutting Putty Tape




5. Place one piece of the putty tape lengthwise along each cable flush against the connector headshells. The distance from the back of each headshell to the ends of each tape should be 7 cm (2 3/4 in).

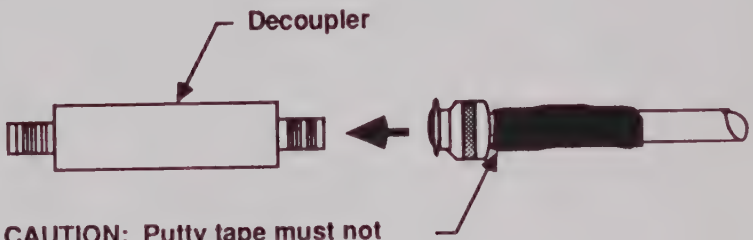
6. Mold the tape around each cable.

Molding Tape Around Cable

7. Slide the shrink tubing onto one cable so that the long plastic strip inside the tubing trails out toward the connector.

8. Connect the decoupler to the male connectors.

Connecting Decoupler to Male Connectors




**CAUTION: Putty tape must not protrude above the back of the connector.**

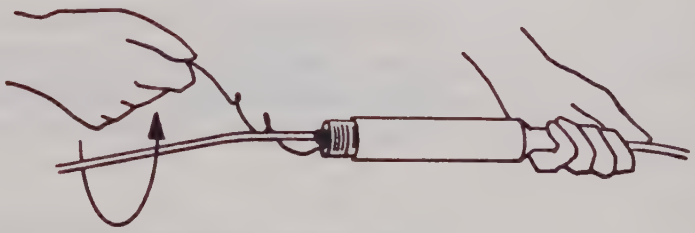
9. Use an ohmmeter to test the sensor cable connections for both zone A and B. To do this you must be at the detection unit. Disconnect the sensor cables and measure the resistance. You should detect the 130 kΩ supervision resistor in the decoupler.

10. Hold the shrink tubing over the decoupler so that 0.5 - 1 cm (1/4 - 1/2 in) of putty tape is exposed on one cable.

11. Collapse the shrink tubing around the decoupler by pulling and unwinding the plastic tape wound inside the tubing, in a counter-clockwise direction. **Unwind the plastic tape using a spiral motion to avoid wrapping it around the cable or the putty tape.** Failure to follow this procedure could result in the plastic tape becoming entangled in the putty tape. If this happens remove the tubing, and repeat the procedure from step 10 with a new piece of tubing.

    Make sure you begin collapsing the tubing so that 0.5 - 1 cm (1/4 - 1/2 in) of the end of putty tape remains exposed. The shrink tubing will stretch as it collapses and should center over the decoupler.

Collapsing Shrink Tubing



12. Repeat the procedure for the other two cables.

# Laying Out the Cable Route

# Laying Out the Cable Route


| | |
|---|---|
| Doing a Site Survey | 5-1 |
| Turning Corners in a Soft Medium | 5-3 |
| Turning Corners in a Hard Medium | 5-8 |
| Laying Out Closed-Loop Crossovers | 5-34 |
| Laying Out Decoupled-Loop Overlaps | 5-36 |
| Avoiding Metallic Obstacles | 5-40 |
| Separating Adjacent Panthers | 5-46 |

**Cable Spacing**

Check the site plan to make sure that the distance between the parallel sensor cables is constant within each zone. The standard spacing is 1 m (3 ft, 3 in). For sites where the cables can be kept at least 10 m (32 ft, 6 in) from metallic objects, an optional spacing of 2 m (6 ft, 6 in) can be used.

# Turning Corners in a Soft Medium

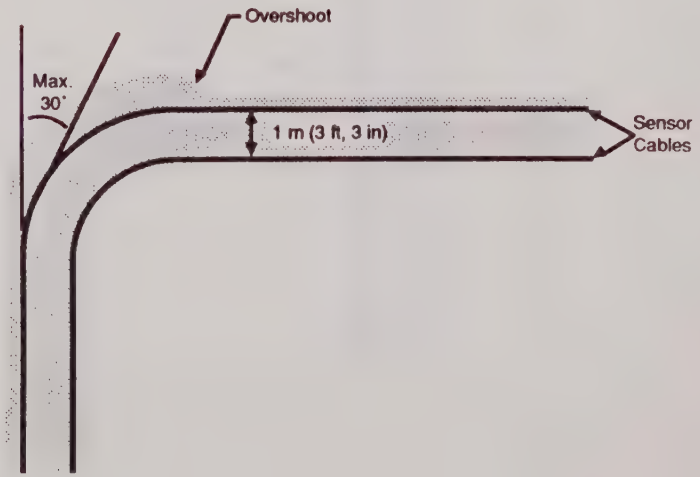
**Smooth Curves**

In places where the cables must turn corners in soil or gravel, use a smooth curve with gradual turns not exceeding 30° (see figure below). The smooth curve will help keep the detection field centered over the cables as it goes around the corner. The sharpness of the corner is determined by the radius of the turn. The minimum radius of the turn depends on whether or not there are large metal objects near the turn.

**Detection Field Overshoot**

The figure below shows you how the detection field is shaped when it goes around a sharp corner. This is called a detection field overshoot.

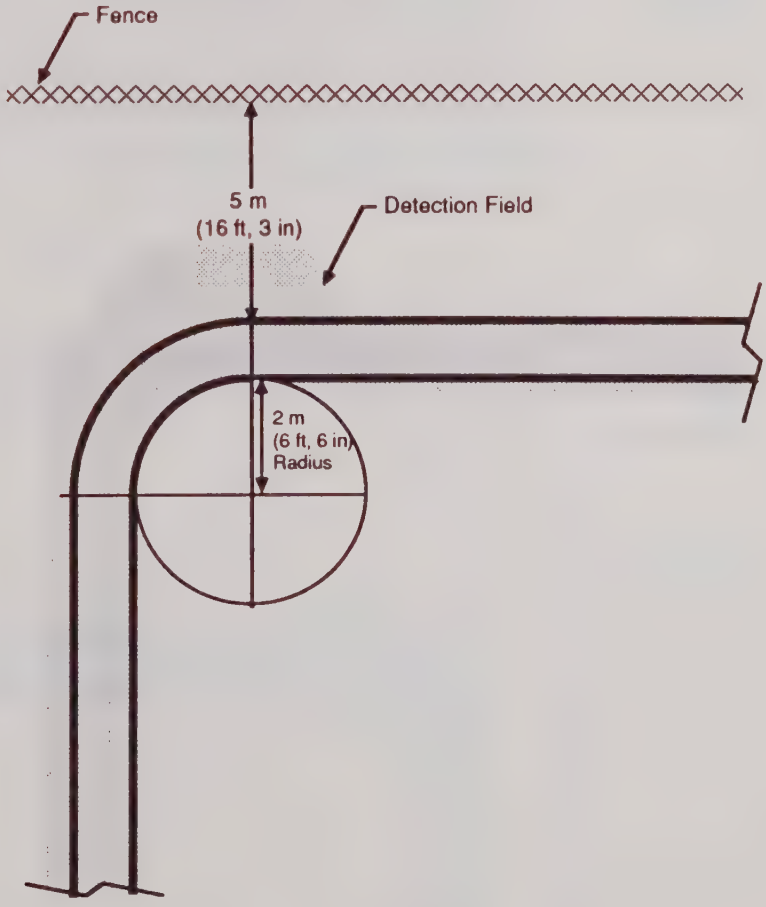
Overshoot on Sharp Corners



**No Metal Objects Nearby: 2 m Radius**

You can turn the corner more sharply by using a turn radius of 2 m (6 ft, 6 in), if there are no metal fences or roadways within 5 m (16 ft, 3 in) of the turn, in the direction of the overshoot.

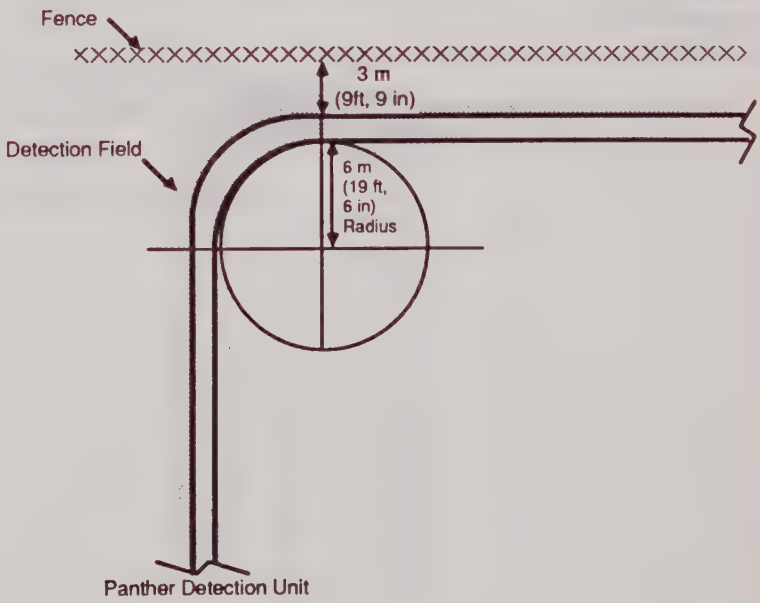
Turn Radius of 2 m - No Fence Within 5 m



**Near Metal Objects: 6 m Radius**

If there is a metal fence or a frequently used roadway within 5 m (16 ft, 3 in) of the turn in the direction of the overshoot, you must turn the corner with a minimum radius of 6 m (19 ft, 6 in). This will produce a gradual turn so that the detection field doesn't stray too far from the sensor cables.

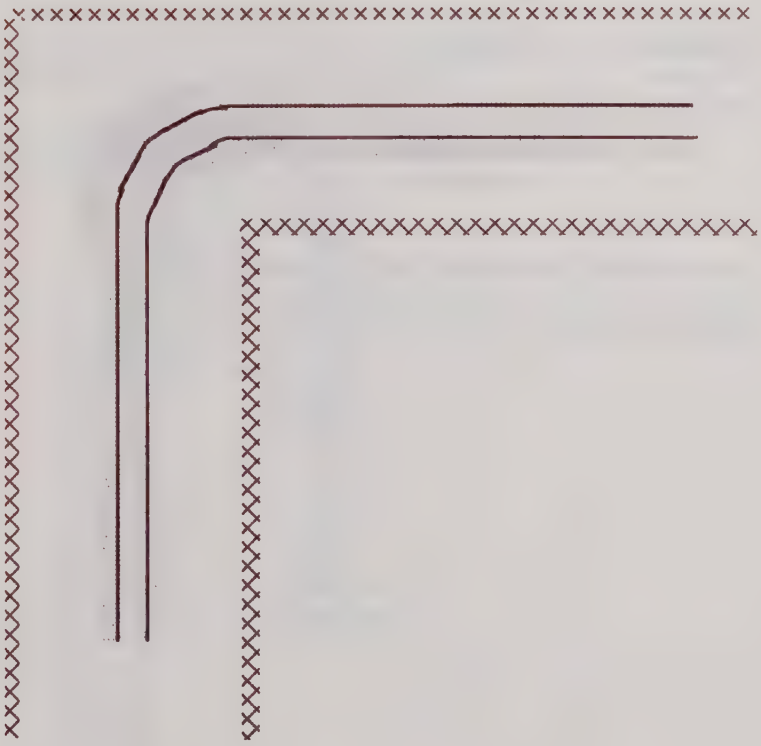
Turn Radius of 6 m - Fence Within 5 m



**Tight Turns Near Metal Objects: Three, 2 m Radius Turns**

If you're turning a corner near a fence and you can't possibly fit in a turn with a 6 m (19 ft, 6 in) radius, you can use three turns with a 2 m (6 ft, 6 in) radius as shown below. The three turns are 30° or less, and so won't cause the detection field to stray too far.

Three 30° Turns - Located Between Two Fences



**Follow the Guidelines**

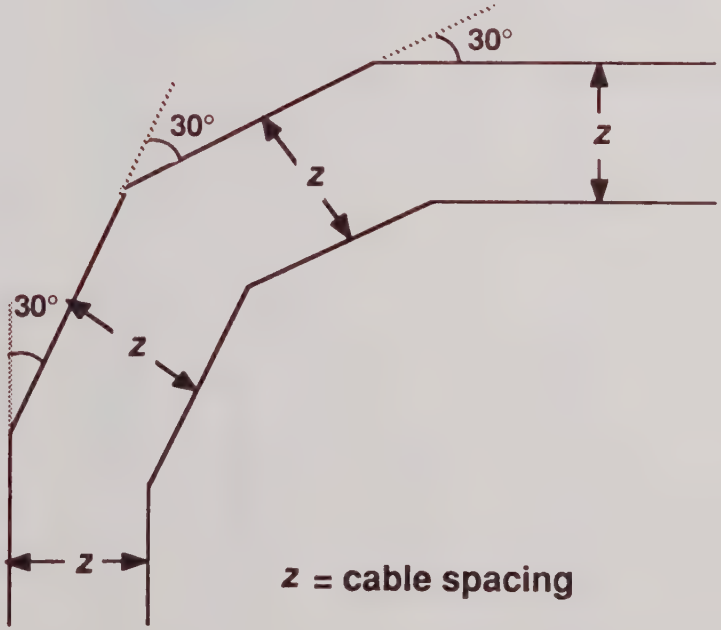
There are tables on pages 5-42 and 5-43 that tell you how far away you can place the sensor cables from certain objects in certain soil types. You can actually place the cables closer than 5 m (16 ft, 3 in) away from some objects in certain soil types. Make sure that you follow the guidelines closely.

# Turning Corners in a Hard Medium

**Straight Segments**

In places where the cables must turn corners in pavement, it's impractical (if not impossible) to cut smooth curves. Instead, cut a series of straight segments with each segment changing direction by a maximum of 30°. A 90° corner requires three 30° turns in succession.

90° Corner Using 30° Turns



As with turns in soil, turns in concrete and asphalt have a radius that is determined by the proximity of large metal objects. If there are no fences or objects within 5 m (16 ft, 3 in) of the outside cable, use a 2 m (6 ft, 6 in) radius. If fences or objects are closer than 5 m (16 ft, 3 in), use a 6 m (19 ft, 6 in) radius. See the previous section for more details.

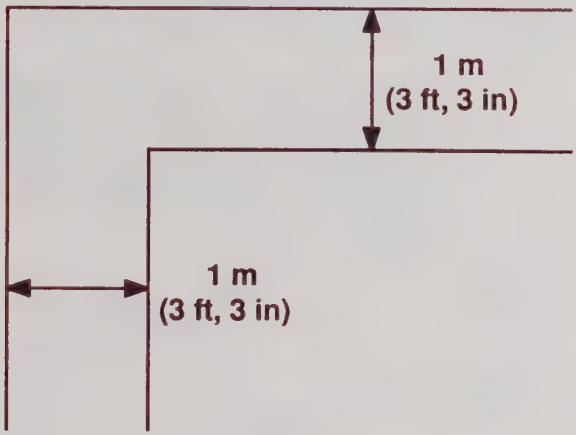
Procedures are given which show you how to lay out three 30° turns when using 1 m or 2 m spacings for both a 2 m and a 6 m radius. A procedure is also given for laying out turns when you're using spacings between 1 and 2 m, for a 2 m or 6 m radius.

**1 m Spacing, 2 m Radius**

Use the following procedure for turning 90° when using 1 m spacing:

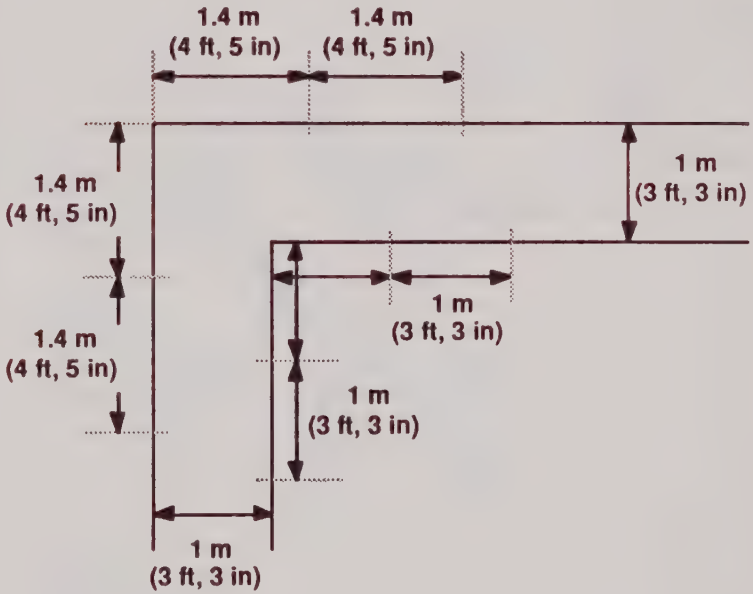
1. Mark the route as though the turn was exactly 90°.

Marking Route - 1 m Spacing



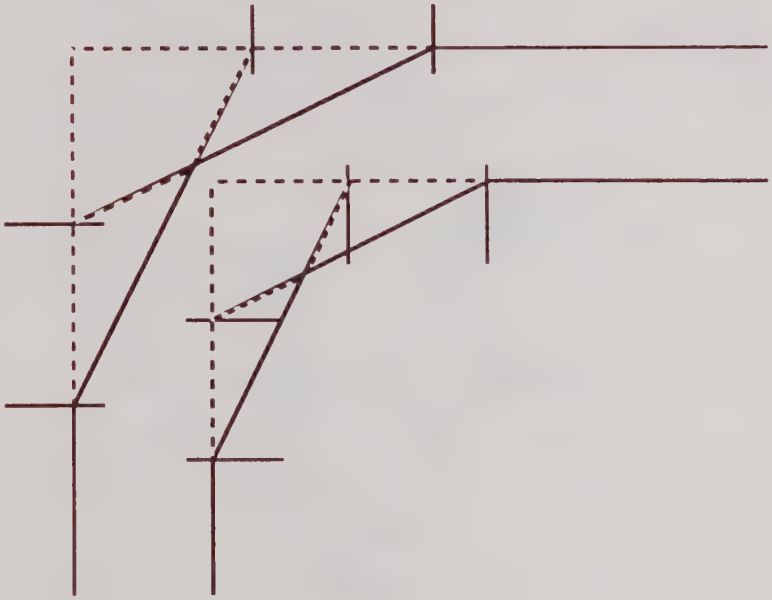
2. Measure and mark the index points.

Measuring and Marking Index Points



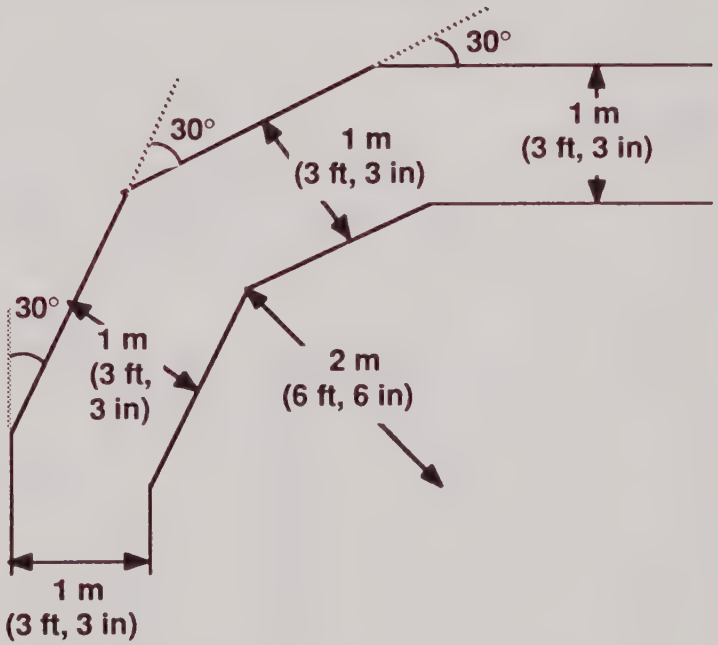
3. Mark the route shown by the index points.

Connecting Index Points



4. Cut along the marked route.

Cutting Along Marked Route

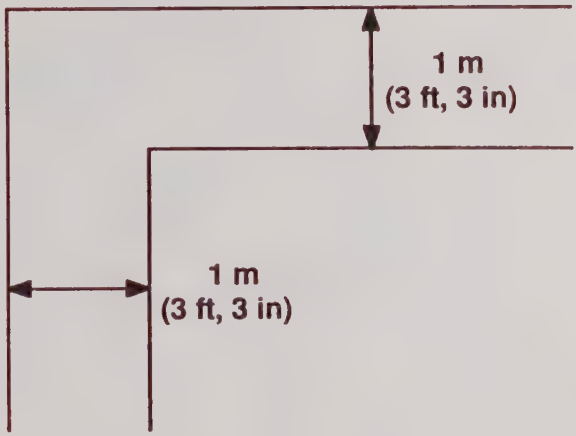


**1 m Spacing, 6 m radius**

Use the following procedure for turning 90° when using 1 m spacing:

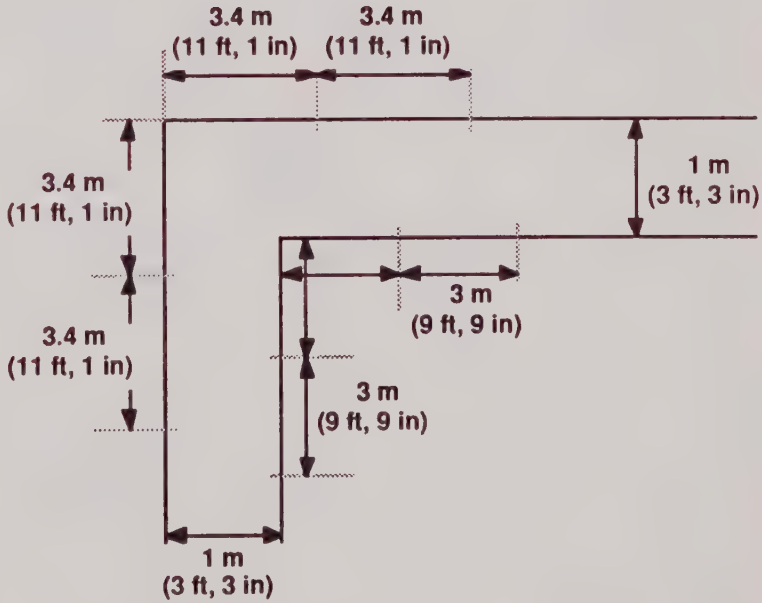
1. Mark the route as though the turn was exactly 90°.

Marking Route - 1 m Spacing



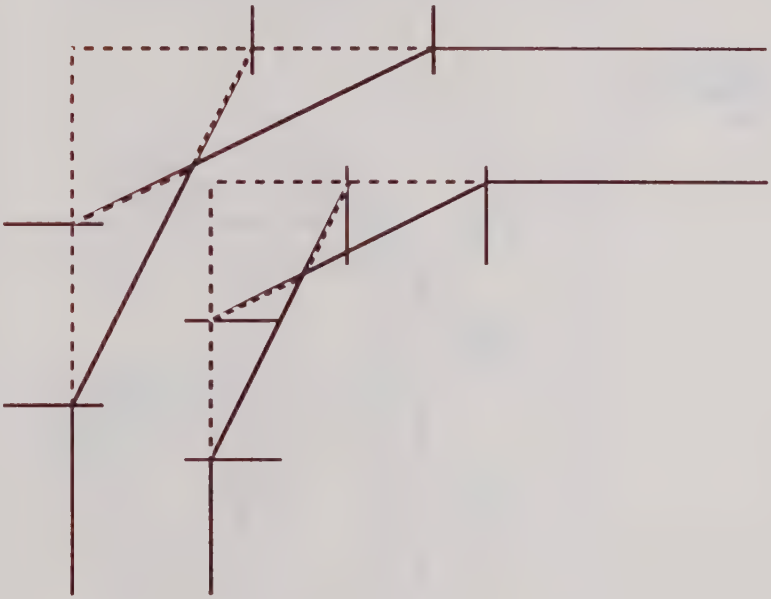
2. Measure and mark the index points.

Measuring and Marking Index Points



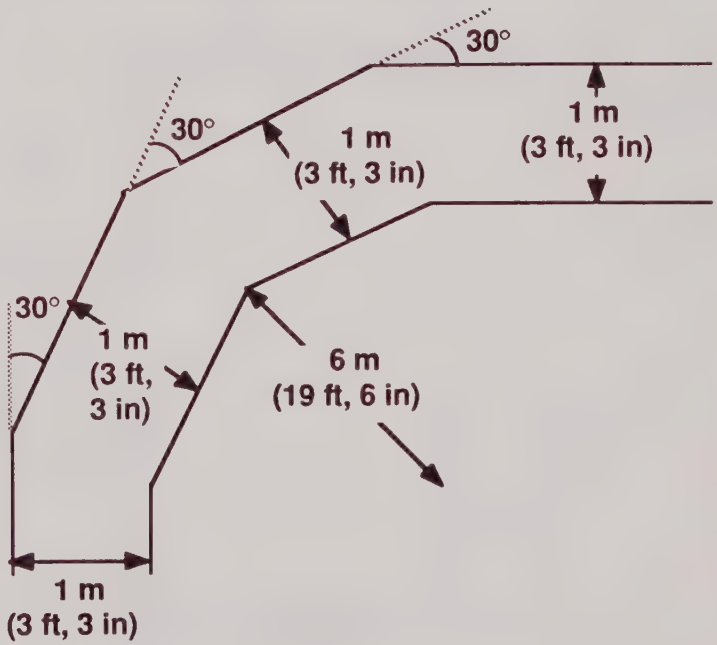
3. Mark the route shown by the index points.

Connecting Index Points



4. Cut along the marked route.

Cutting Along Marked Route

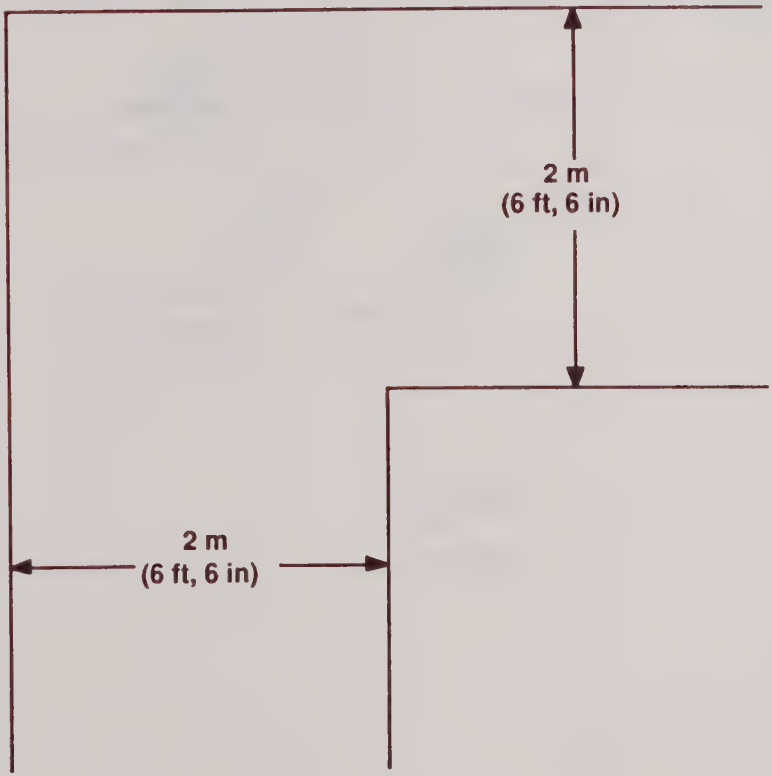


**2 m Spacing, 2 m radius**

Use the following procedure for turning 90° when using 2 m spacing:

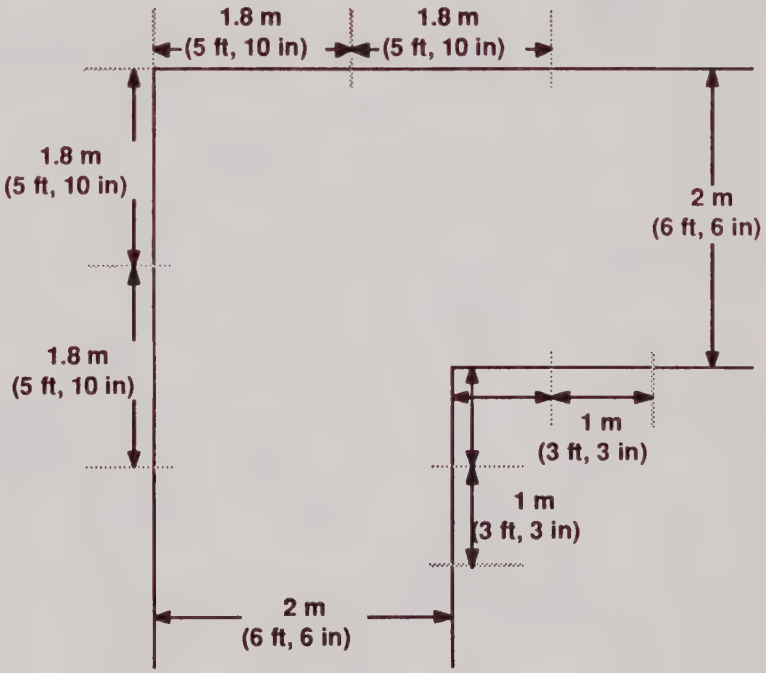
1. Mark the route as though the turn was exactly 90°.

Marking Route - 2 m Spacing



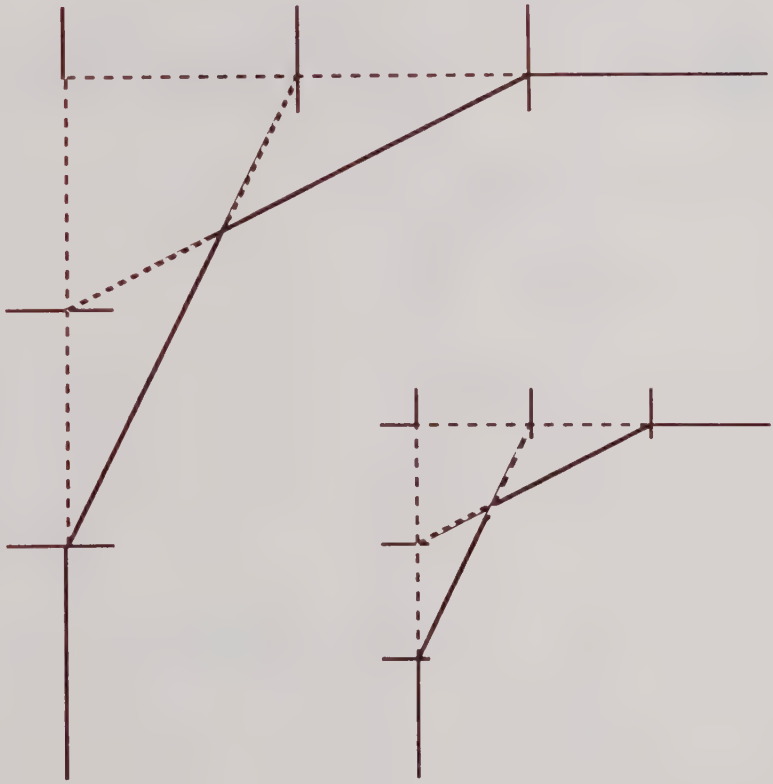
Measuring and Marking Index Points

2. Measure and mark the index points.



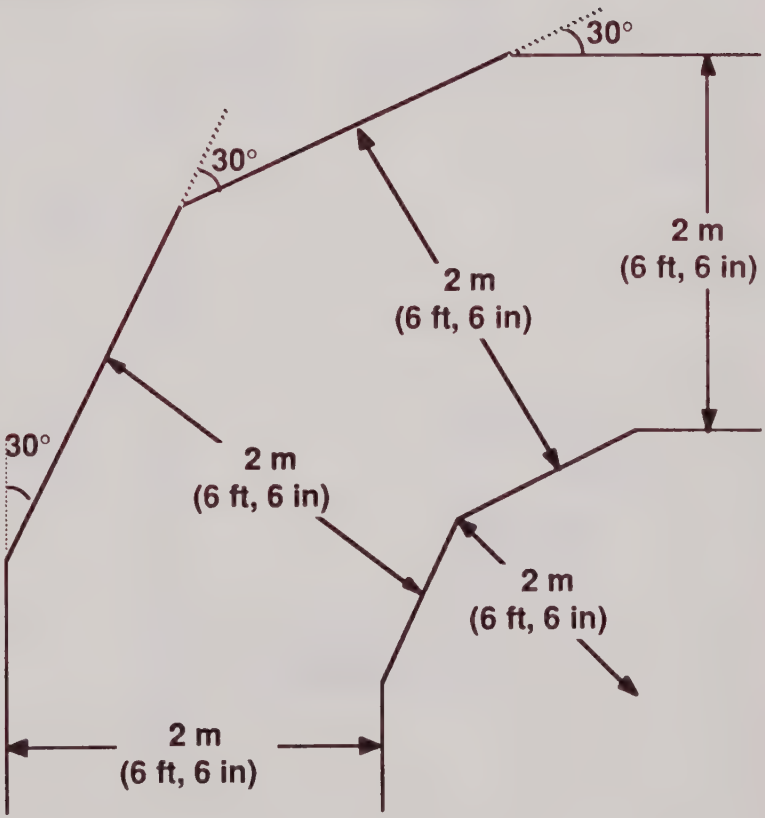
Connecting Index Points

3. Mark the route shown by the index points.



4. Cut along the marked route.

Cutting Along Marked Route

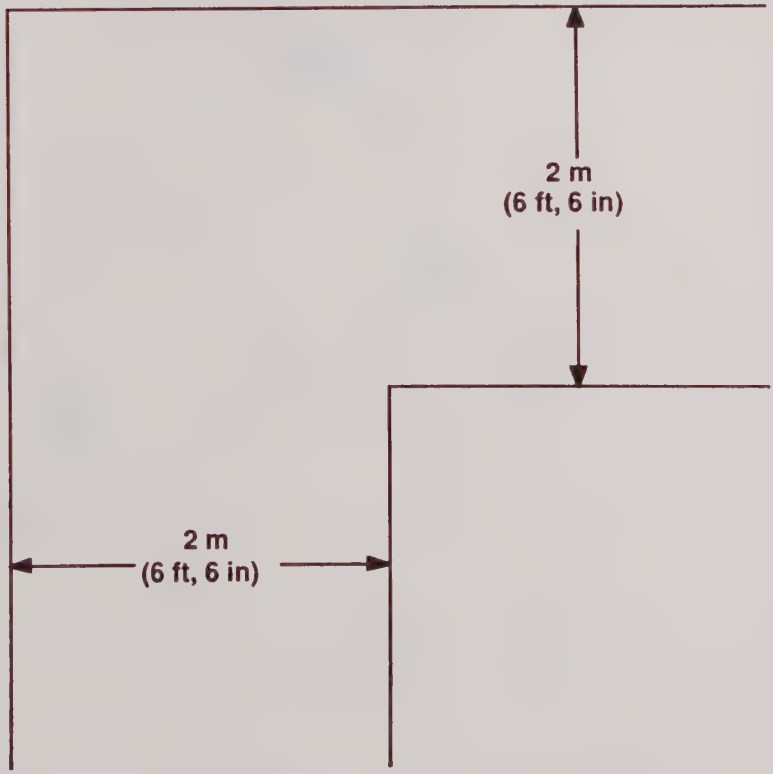


**2 m Spacing, 6 m radius**

Use the following procedure for turning 90° when using 2 m spacing:

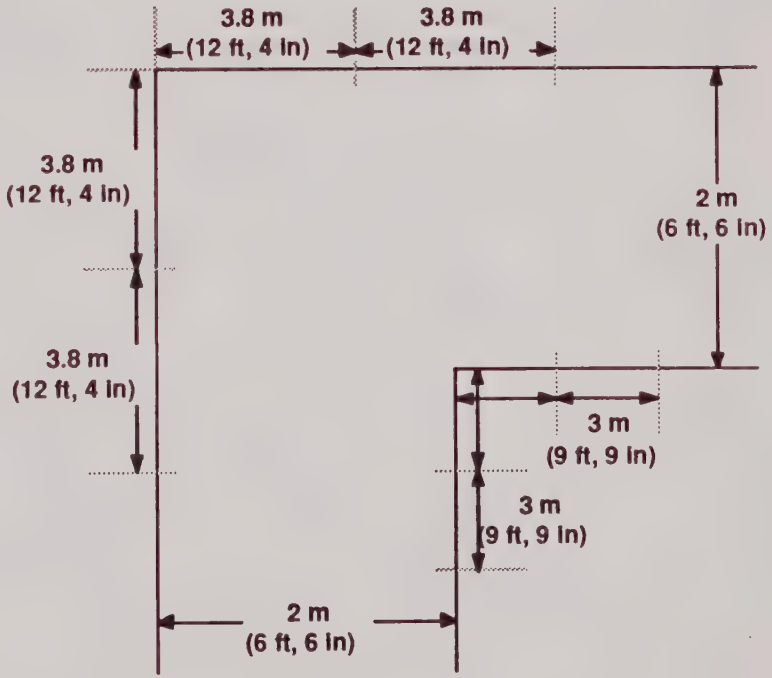
1. Mark the route as though the turn was exactly 90°.

Marking Route - 2 m Spacing



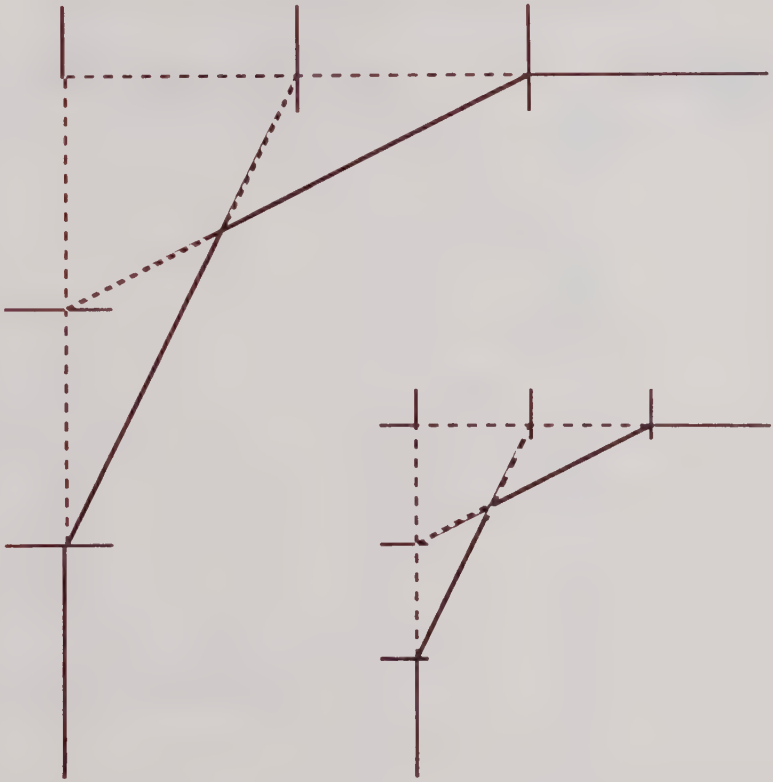
2. Measure and mark the index points.

Measuring and Marking Index Points



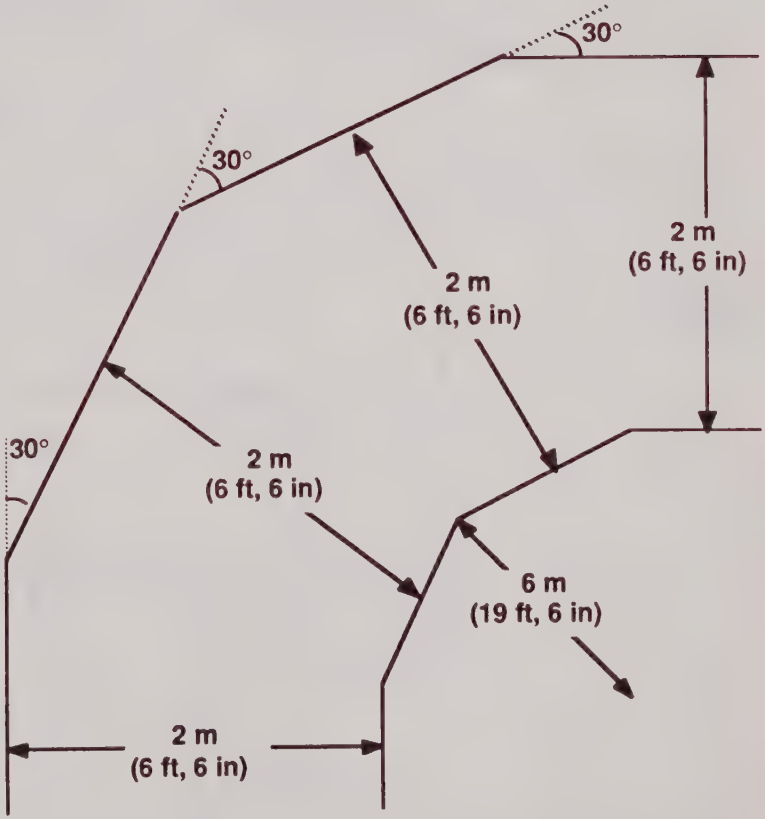
Connecting Index Points

3. Mark the route shown by the index points.



4. Cut along the marked route.

Cutting Along Marked Route



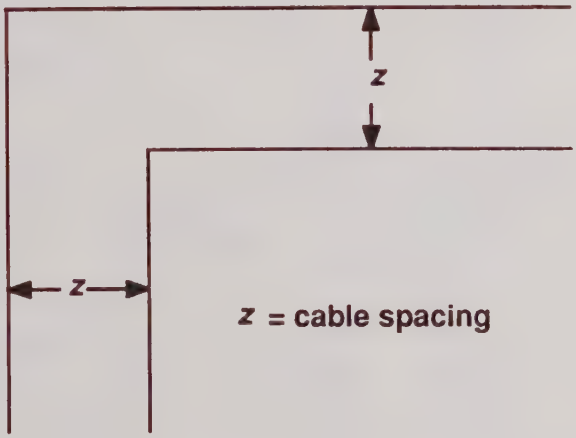
**Non-Standard Spacing, 2 m radius**

Procedures for using non-standard spacing are provided for cases where you require cable spacing between 1 and 2 m.

Use the following procedure for turning 90° when using a non-standard spacing:

1. Mark the route as though the turn was exactly 90°.

Marking Route - Between 1 and 2 m Spacing

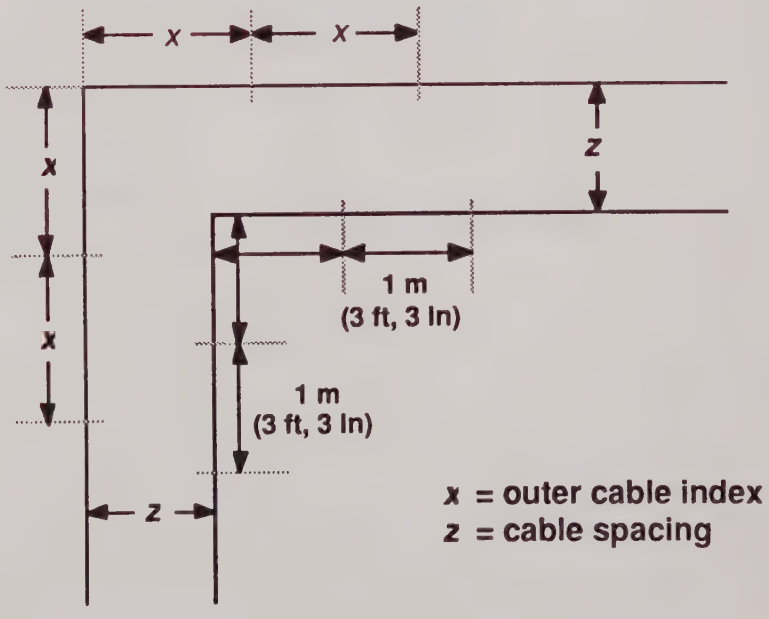


2. Measure and mark the index points. Calculate the distance between index points of the outer cable slot ($x$) by using the equation

$$x = 1 + 0.38z$$

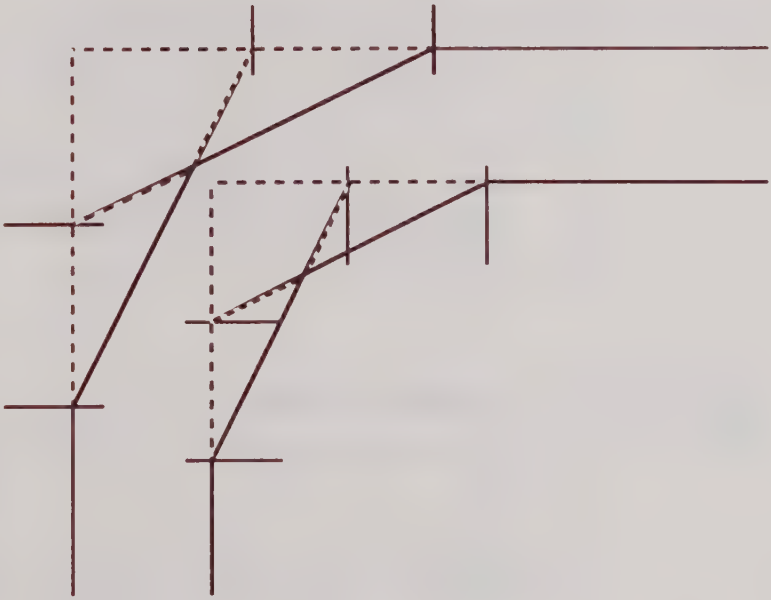
where $z$ is the cable spacing, i.e., the distance between the cables, and $x$ is the distance between the index points of the outer cable.

Measuring and Marking Index Points



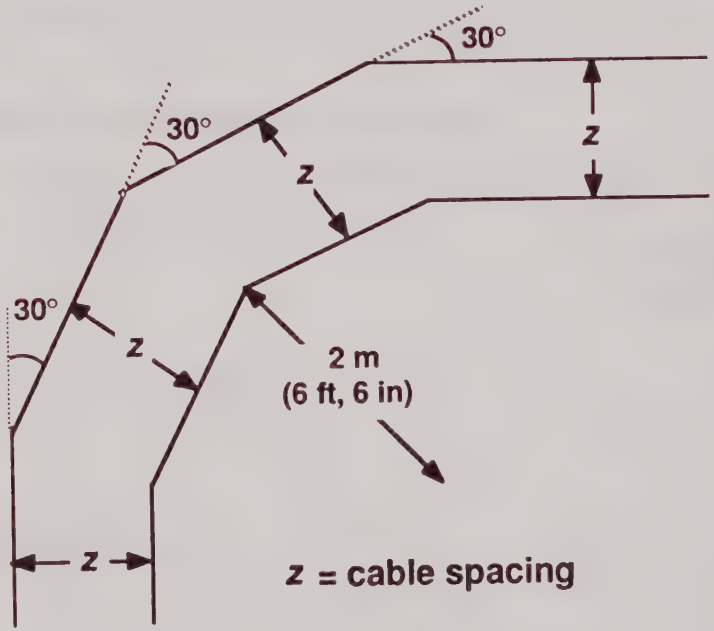
Connecting Index Points

3. Mark the route shown by the index points.



4. Cut along the marked route.

Cutting Along Marked Route



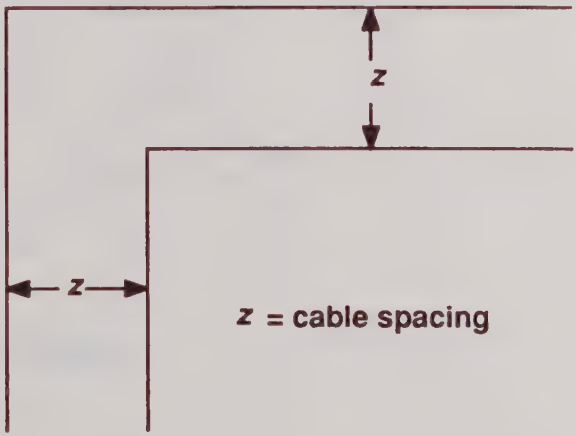
**Non-Standard Spacing, 6 m radius**

Procedures for using non-standard spacing are provided for cases where you require cable spacing between 1 and 2 m.

Use the following procedure for turning 90° when using a non-standard spacing:

1. Mark the route as though the turn was exactly 90°.

Marking Route - Between 1 and 2 m Spacing

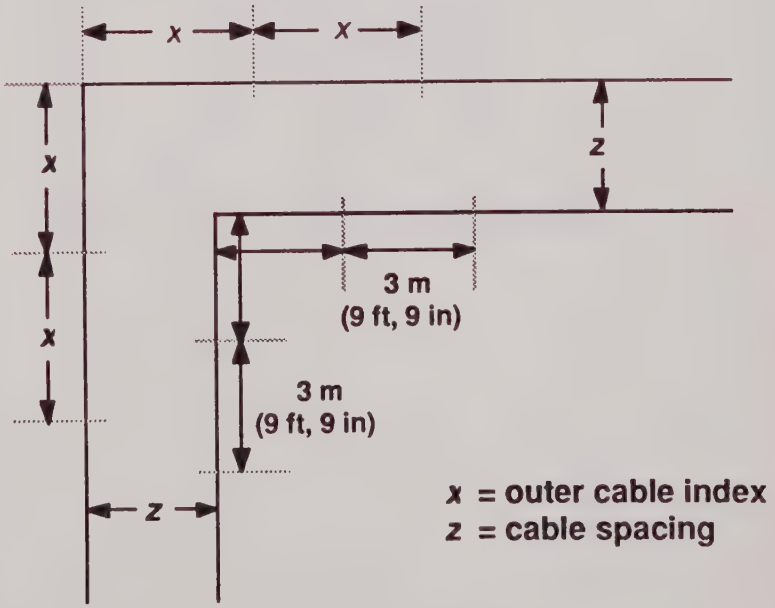


2. Measure and mark the index points. Calculate the distance between index points of the outer cable slot ($x$) by using the equation

$$x = 3 + 0.38z$$

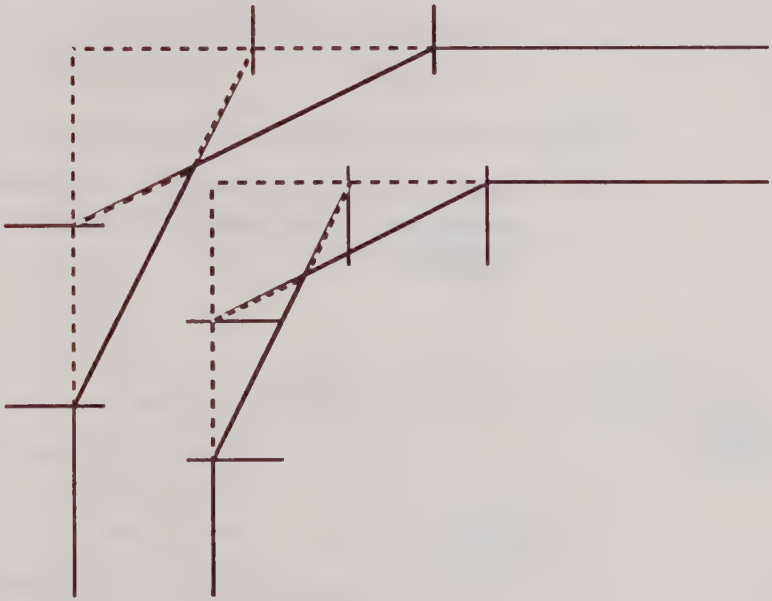
where $z$ is the cable spacing, i.e., the distance between the cables, and $x$ is the distance between the index points of the outer cable.

Measuring and Marking Index Points



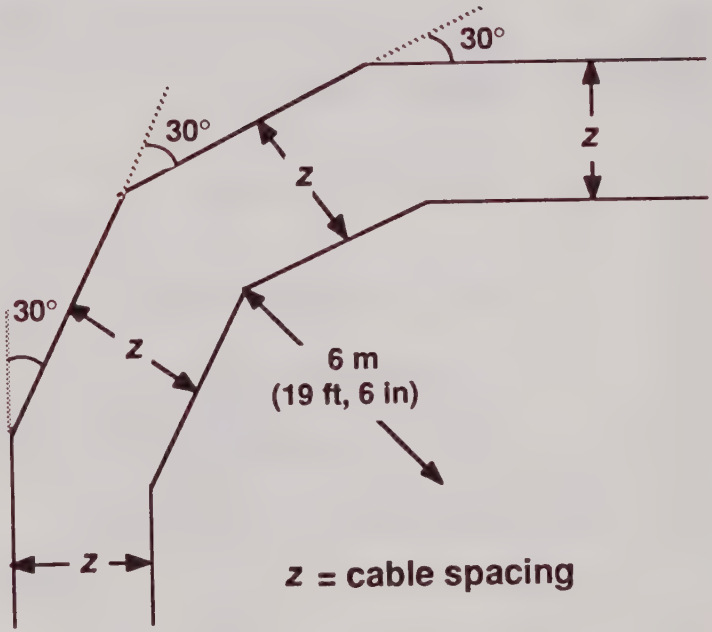
3. Mark the route shown by the index points.

Connecting Index Points



4. Cut along the marked route.

Cutting Along Marked Route



# Laying Out Closed-Loop Crossovers

**Cable Crosses Itself**

In single- and two-zone closed-loop configurations, the cable route crosses over itself at the end of each zone. The cables must cross each other to:

- avoid interference
- provide total protection

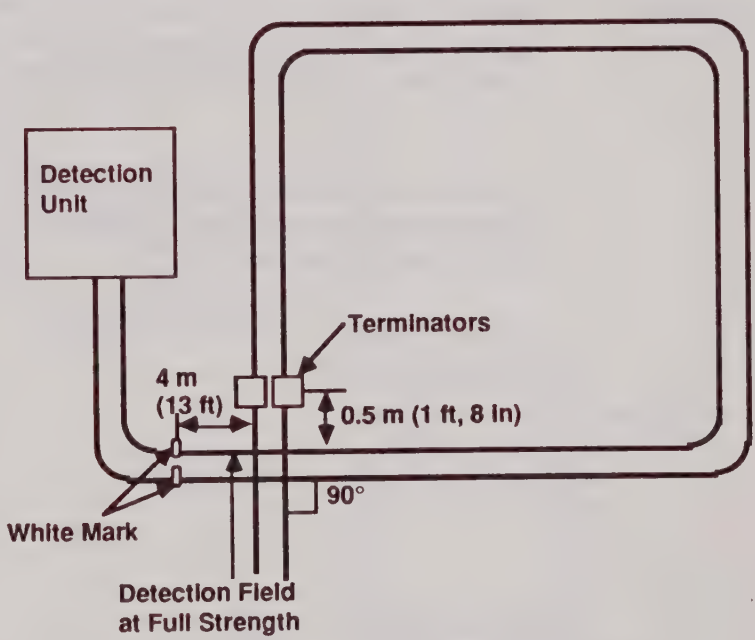
These goals can be achieved by:

- crossing the cables at 90°
- making sure the end of the cable route crosses itself at a point where the detection field is at full strength

## Terminator at Full-Strength Section

A terminator is used at the end of each zone. The 4 m (13 ft) piece of cable on the end of the terminator is what actually crosses the full-strength section of the zone.

Terminator Cable Stub Crossing Cable



# Laying Out Decoupled-Loop Overlaps

**Overlapping Detection Fields**

A special type of closed loop is formed by a two-zone, decoupled system. The sensor cables from each of the two zones are joined together using decouplers. Decouplers allow the detection field of each zone to overlap and provide full-strength coverage.

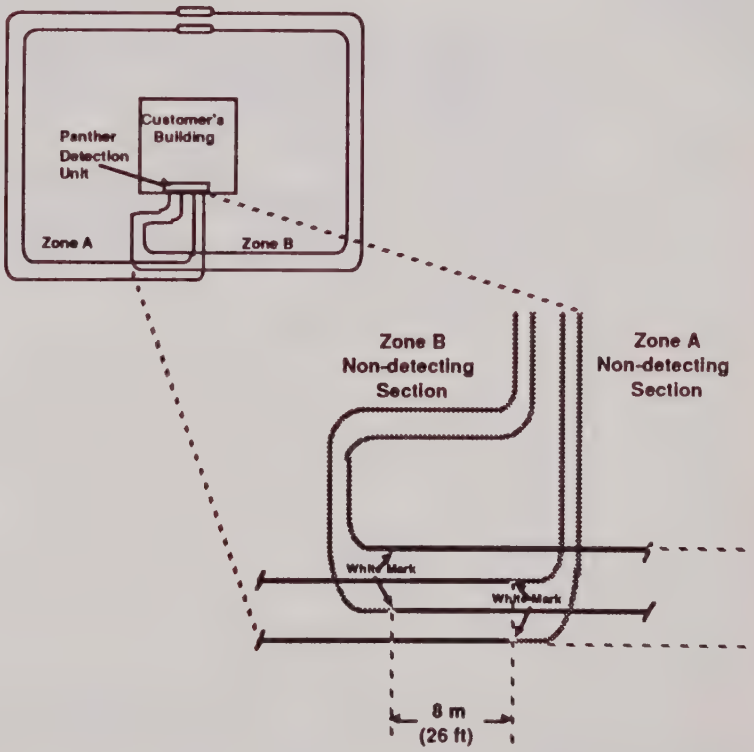
For two-zone, decoupled configurations, the sensor cables overlap near the cable entrance area to completely enclose the perimeter. This overlap area is:

- 8 m (26 ft) long
- 1.5 m (5 ft) wide

These overlap dimensions are independent of cable spacing.

Make sure there is enough room for the overlap to be installed.

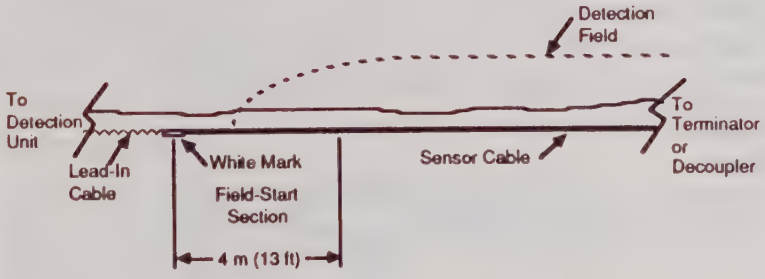
Overlapping Sensor Cables at Field-Start Section



## Field-Start Sections

You must overlap the zones at the point where the detection field starts up. The detection field requires 4 m (13 ft) to build up to full strength after it leaves the white painted mark on the cables.

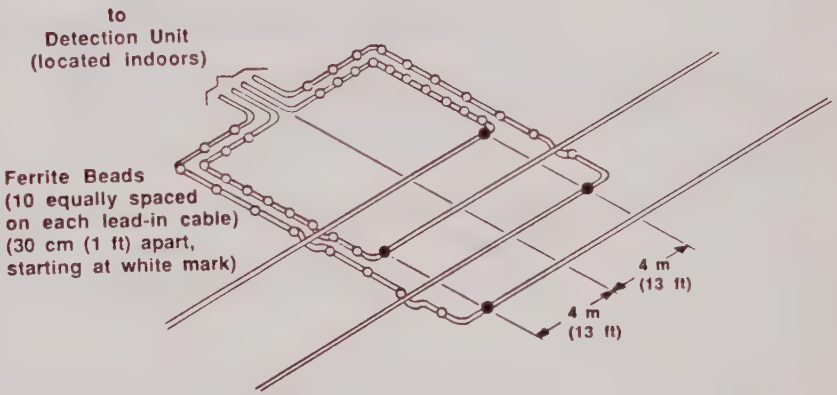
Detection Field Building Up in Field-Start Section



**8 m Detection Field Overlap**

By placing the white marks of each zone 8 m (26 ft) apart at the overlap, you're ensuring that the detection fields of both zones will overlap 4 m (13 ft) to provide effective coverage.

Detection Fields Overlapping for Full Protection




This overlap area:

- allows the detection field in each zone to build to full strength
- provides overlapping, full-strength coverage

## Avoiding Metallic Obstacles

Metallic obstacles present two problems:

- the cables must be routed around them
- they may be detected by Panther, and trigger false alarms

To prevent any problems:

- Keep the cable route at least 2 m (6 ft, 6 in) away from all obstacles.
- Do not route the cables under metallic fences

Underground obstacles don't cause as many false alarms as above-ground obstacles because underground obstacles don't move easily. However, it's still a good rule of thumb to keep the cable route away from any obstacles.

**Using the Table**

The table on the next page gives the minimum distances that the closest sensor cable can be from certain types of obstacles. The distances are given under the assumption that you're using a 1 m (3 ft, 3 in) spacing between the cables. If you're using a 2 m (6 ft, 6 in) spacing there is a table on page 5-43 that gives you some minimum separation distances.

Notice that the distances depend on the type of soil as well as the type of object. Make sure your installation meets the guidelines given in these tables.

Required Separation Between Sensor Cables and Metallic Objects For 1 m (3 ft, 3 in) Cable Spacing

| Type of Object | Burial Medium | | | |
|---|---|---|---|---|
| | Light Soil | Asphalt/ Concrete | Medium Soil | Heavy Soil |
| High-Quality Fence<br>A very rigid structure with no possibility of intermittent electrical contacts (e.g., a welded wire fence with concrete poles) | 2.5 m (8 ft, 2 in) | 2.0 m (6 ft, 6 in) | 2.0 m (6 ft, 6 in) | 1.5 m (4 ft, 11 in) |
| Medium-Quality Fence<br>A rigid structure which moves less than 1.3 cm (1/2 in) at a height of 2.4 m (8 ft) above ground under worst-case wind conditions [fabric tensioned for less than 1.3 cm (1/2 in) movement under a 13.6 kg (30 lbs) pull] (e.g., a standard chain-link fence) | 3.0 m (9 ft, 9 in) | 2.7 m (8 ft, 9 in) | 2.7 m (8 ft, 9 in) | 2.5 m (8 ft, 2 in) |
| Low-Quality Fence<br>Any metallic fence other than the above | 5.0 m (16 ft, 3 in) | 4.0 m (13 ft) | 3.0 m (9 ft, 9 in) | 2.5 m (8 ft, 2 in) |
| Small Moving Metallic Objects<br>(e.g., cars, bicycles) | 5.0 m (16 ft, 3 in) | 4.0 m (13 ft) | 4.0 m (13 ft) | 3.0 m (9 ft, 9 in) |
| Large Moving Metallic Objects)<br>(e.g., trucks, aircraft) | 5.0 m (16 ft, 3 in) | 5.0 m (16 ft, 3 in) | 5.0 m (16 ft, 3 in) | 4.0 m (13 ft) |

In special circumstances, where there is a large distance between the sensor cables and the nearest metallic fence or vehicle, you can use a wider spacing of 2 m (6 ft, 6 in). If this spacing is used, you must increase the separation distance between the sensor cables and metallic objects.

Required Separation Between Sensor Cables, Fences or Moving Metal Objects

For 2 m (6 ft, 6 in) Cable Spacing

| | Burial Medium | | | |
|---|---|---|---|---|
| | Light Soil | Asphalt/ Concrete | Medium Soil | Heavy Soil |
| Separation | 10.0 m (32 ft, 6 in) | 9.0 m (29 ft, 3 in) | 8.0 m (26 ft) | 6.0 m (19 ft, 6 in) |

## Metallic Fences

Metallic fences can cause false alarms if they are in poor condition and if they move in the wind.

- Keep the cable route as far away as possible from any metallic fences and never closer than 2 m (6 ft, 6 in).
- If the fence is in poor condition, have it removed or replaced.
- If possible, make the replacement fence non-metallic.

**Buildings**

If the cable route ends while approaching a building wall at 90°, place the connectors for the terminators 8 m (26 ft) from the wall. This prevents the detection field from continuing through the wall and detecting the occupants moving inside. In most installations, the cables will run parallel to a wall, but never closer than 2 m (6 ft, 6 in), for the same reason.

If you require protection right up to the wall, you must use another type of sensor (e.g., microwave sensor).

**Water**

Water in a ditch, pond, or non-metallic drainage pipe can cause false alarms as it fills and drains.

- Make sure the cables are installed in areas with good drainage.
- Make sure all drainage pipes are metallic.
- Cables routed near a building must not be under the roof drip line.

## Metallic Objects

Moving metallic objects can cause false alarms. Buried metallic objects can distort the detection field and create an area of low sensitivity. For these reasons:

- Keep the sensor cables at least 4 m (13 ft) away from roads where there may be moving traffic. (Refer to the table on page 5-42.)
- Remove visible metallic debris.
- Check for buried debris with a metal detector and remove it if necessary.

## Underground Pipes/Cables

Separate any underground pipes or cables from the sensor cables, by the minimum distances shown in the following table:

Separating Sensor Cables from Underground Pipes and Cables

| Obstacle | Minimum Separation Distance |
|---|---|
| Pipe or cable perpendicular to the cable path | 5 cm (2 in) |
| Pipe more than 10 cm (4 in) in diameter perpendicular to the cable path | 61 cm (24 in) |
| Pipe or cable parallel to the cable path | 30 cm (12 in) |
| Plastic pipe carrying running water | 30 cm (12 in) |

## Separating Adjacent Panthers

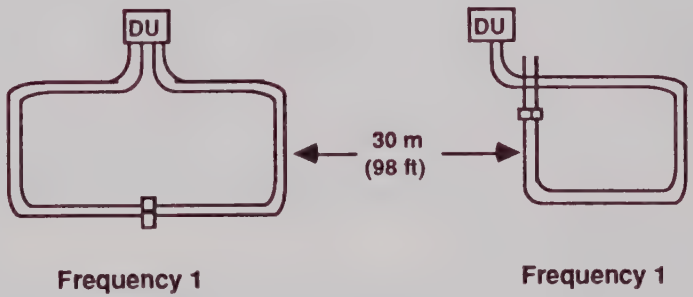
If you have other Panther systems operating nearby, there are a few rules that you must follow in order to prevent interference.

Panther can operate on two or three user-selectable frequencies. If you select the frequencies so that adjacent Panther systems are operating on different frequencies, you can place the Panther systems closer together. If they all operate on the same frequency, you must place them further apart.

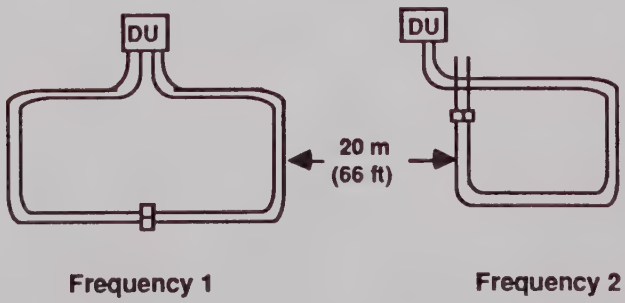
The minimum separation distances are also dependent on whether adjacent Panther cables are parallel to each other, or face each other end-to-end.

If you place the Panthers so that the cables of each system run parallel to each other, the minimum separation distance is 30 m (98 ft), if the adjacent units are operating on the same frequency. The minimum separation distance can be reduced to 20 m (66 ft) if the adjacent systems are operating on different frequencies.

Same Frequency, Parallel Cables

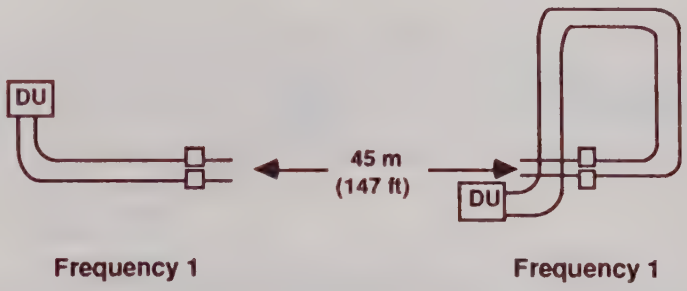



Different Frequencies, Parallel Cables

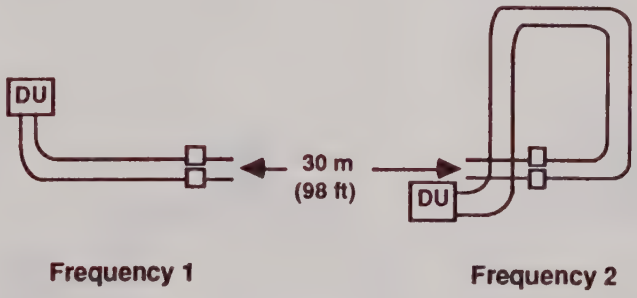


Similarly, if you place the Panthers so that the cables of each system are end-to-end, the minimum separation distance is 45 m (148 ft) if the adjacent units are operating on the same frequency. The minimum separation distance can be reduced to 30 m (98 ft) if the adjacent systems are operating on different frequencies.

Same Frequency, End-to-End Cables




Different Frequencies, End-to-End Cables




It is important that you follow these guidelines. Failure to do so may result in false alarms. For information about how to select Panther's frequencies, see the section on Solving False Alarms, in the Troubleshooting and Repair chapter.

# Installing the Cables

# *Installing the Cables*


| | |
|---|---|
| Cable Installation Overview | 6-1 |
| Checking the Cables | 6-5 |
| Attaching Labels and Ferrite Beads | 6-8 |
| Installing in Soil | 6-11 |
| Installing in Gravel | 6-14 |
| Installing in Concrete or Asphalt | 6-18 |
| Installing an Overlap | 6-38 |
| Creating Areas of No Detection | 6-40 |
| Running Lead-in Cable Indoors | 6-45 |

# Cable Installation Overview

This section gives you general information about how the sensor cables are installed along the cable route.

Cable channels can be cut into four different mediums:

- soil
- gravel
- concrete
- asphalt

Soil and gravel are soft mediums; concrete and asphalt are considered to be hard mediums.

The table on the next page gives a summary of the installation methods that can be used for each medium.

## Mediums and Methods

| Medium | Installation Methods |
|---|---|
| Soil | • slits cut with a sod cutter or spade<br>• narrow trenches cut with a small trenching machine |
| Gravel | • narrow trenches cut with a small trenching machine |
| Concrete/Asphalt | • slots cut into surface with a concrete saw |

This section provides instructions for installing cables using any of the installation methods given in the above table.

**Key Points**

Wherever possible, route the cables through soil. It requires the least labor, and is the least expensive method of installation.

- Even if a zone isn't routed through soil, attempt to place the terminators or decouplers in soil.
- Make sure it's possible to bury the sensor cables at all points on the perimeter.
- The sensor cables MUST be buried for Panther to work properly.
- Cables can not be placed in metal or plastic conduit. They must be in contact with the burial medium. There must be no air spaces around the cables.

Before you begin to cut slots or trenches, make sure you move the cables away from the work area and equipment after cable preparation. You must take every precaution against damaging the cables. Handle the cables with care when laying them into the ground.

Before you bury the cables make sure that you have:

- installed the ferrite beads, connectors and terminators or decouplers
- tested the cables for continuity

Wherever possible, try to install one cable at a time. This means that you should cut one slot or trench, install the cable, restore the ground and then repeat the process for the other cable. This may not be practical when using a concrete saw, but you should use this technique for all other installations. If you try to cut the second trench or slot immediately after cutting the first, you may find that your equipment is continually getting caught in the other trench.

## Checking the Cables

Before you bury the cables you must:

- test the cables for electrical continuity
- make sure you've positively identified the non-detecting, or lead-in, section
- ensure that you have enough cable for the site
- fasten the ferrite beads to the lead-in section
- waterproofed underground connections (using shrink tubing)

Each of these procedures is described on the following pages.

### Continuity Test

To test the cable for continuity and shorts:

1. Open the cable caddy to access both ends of the cable. Strip both ends of the cable with the Panther stripping tool.

2. Use an ohmmeter to test the center conductor for continuity.

3. Test the braided shield for continuity.

4. Make sure the center conductor and the braided shield are not shorted.

### Identifying Lead-In Cable

The non-detecting lead-in cable is dispensed first. If you have any doubts about the orientation of the cable, look at the stripped cable end and note the following identifying features:

- The non-detecting section has an internal foil layer.
- The detecting section does not have a foil layer.

### Unrolling the Cables

The sensor cables can be conveniently laid out along the cable route by using the following procedures:

1. Securely anchor one end of the sensor cable. Place it under a heavy rock or have someone stand on one end.

2. Hold the cable caddy in one hand and walk the cable route.

3. Make sure the non-detecting lead-in section is unrolled at the detection unit location.

## Checking the Cable Length

To check the cable length:

1. Lay the cables along the proposed route with the correct spacing.

2. Lay out the field-start section.

3. Do not cut the cables at this time.

4. Make sure the cables are of adequate length.

5. Make sure there is enough lead-in to reach the detection unit inside the building.

## Inspecting the Cables

Inspect the outer jacket for damage along the length of the cable. The cable MUST be waterproof. If damage is detected:

- Repair the damage. See the chapter on Troubleshooting and Repair.
- Replace cables with major damage. See the chapter on Troubleshooting and Repair.

## Attaching Labels and Ferrite Beads

**Label Procedure**

Attach the supplied cable identification labels to the lead-in section of each cable. To attach the labels:

1. Make sure the non-detecting section is located closest to the detection unit.

2. Label both ends of all cables with the supplied labels.

   - TXA = Transmit cable, zone A
   - RXA = Receive cable, zone A
   - TXB = Transmit cable, zone B
   - RXB = Receive cable, zone B

3. ALWAYS make the inner cable (the one on the protected side of the perimeter) the receive (Rx) cable.

4. Keep the extra set of labels for marking the cables after they have been trimmed to length.

**Ferrite Bead Installation Procedure**

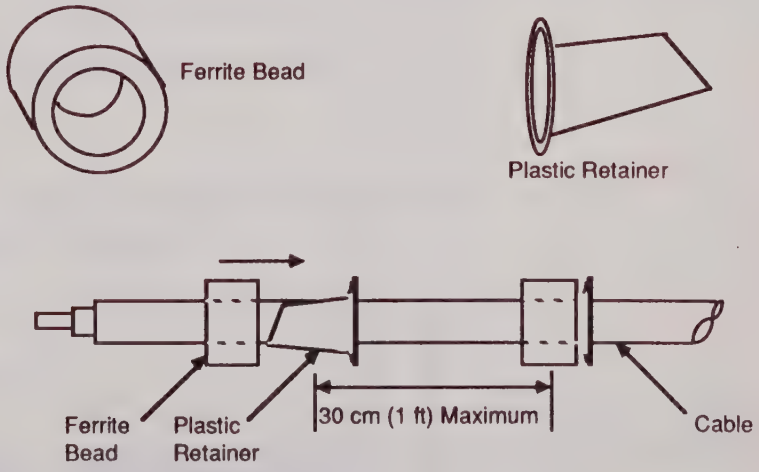
Fasten ferrite beads to the non-detecting lead-in cable to prevent the detection field from straying back to the detection unit. To attach the ferrite beads:

1. Locate the lead-in end of the cable.

2. Slide ten (10) ferrite beads onto the lead-in.

3. Use the supplied retainers to fasten the beads in place as you position them.

Installing Ferrite Beads

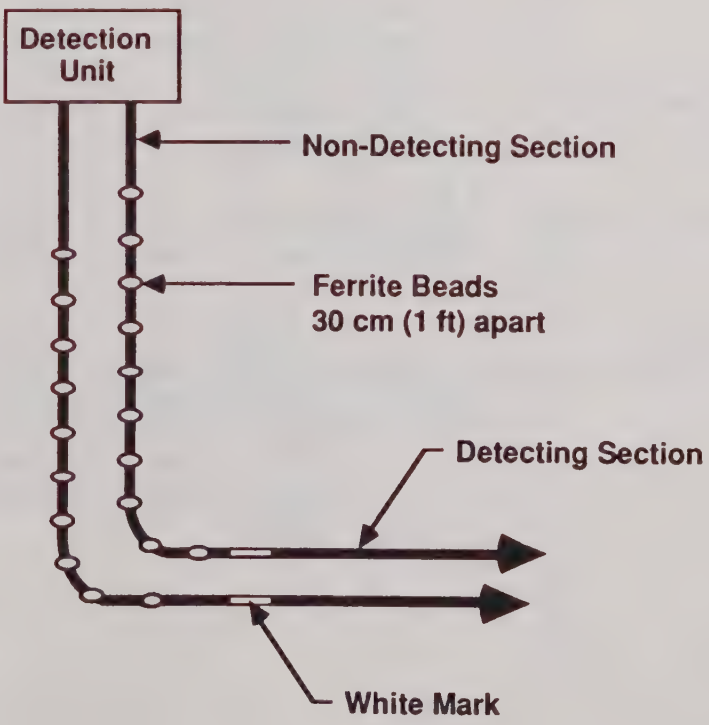


4. Place the first bead on the lead-in section 30 cm (1 ft) from the white mark that indicates the start of the detecting section.

5. Place the second bead on the lead-in section 60 cm (2 ft) from the white mark that indicates the start of the detecting section.

6. Place the remaining eight beads at 30 cm (1 ft) intervals down the length of the lead-in. The tenth bead should be 3 m (10 ft) from the white mark.

Ferrite Beads 30 cm (1 ft) Apart



## Installing in Soil

### Tools and Equipment

To install the cables in soil you will need the following tools:

- cable burial marker stakes
- fluorescent marker paint
- chalk line
- shovel
- grass rake
- small trenching machine
- sod slitter or sod remover
- tools for installing connectors and terminators or decouplers (see the chapter on Installing the Cable Fittings for details)
- sand (required for rocky soil)

### Site Preparation

1. Ensure that the site plan matches the actual site.

2. Clean debris from the sensor cable paths.

3. Mark the exact cable location on the soil surface with the fluorescent marker paint. If this is impractical, take measurements from reference points instead.

4. Double-check the location markings against the site plan before burying the cables.

**Installation Procedure**

Install one cable at a time using the following procedure:

1. If the surface is grass-covered, and the soil is not rocky, cut a 15 cm (6 in) deep slit with a sod slitter or spade. If the soil is rocky you might consider using a sod remover and a small trenching machine to dig the cable channels.

2. If the surface is bare soil, cut a slit or dig a narrow trench 15 cm (6 in) deep. If you dig a trench, put a mark on a shovel or stick 15 cm (6 in) from the end so you can tell how deep you're digging. Make sure the trench is 15 cm (6 in) deep for the whole length of the trench.

3. If you've cut slits, push the cables 15 cm (6 in) down into the slits. You can use a "push stick" (a piece of lumber 2 cm x 8 cm [1 in x 4 in] with a dull end) to push the cables down. Put a mark on the push stick 15 cm (6 in) from the end so you can tell how deep you're pushing the cables down. Be very careful not to damage the cables.

4. If you've dug narrow trenches with a machine, simply lay the cables at the bottom of the trenches and verify the depth. You can hold the cables in place at the bottom of the trench by packing small mounds of soil around the cables at intervals along the route.

5. Check that the white marks on the cables are correctly positioned according to the site plan.

6. Install the terminators or decouplers at the locations indicated on the site plan. Use the procedures given in the chapter on Installing the Cable Fittings.

7. If you've cut slits into the soil, tamp the soil back into place. If you've dug trenches, backfill the trenches and tamp down the soil. If the soil is rocky, partially backfill with sand to protect the cables.

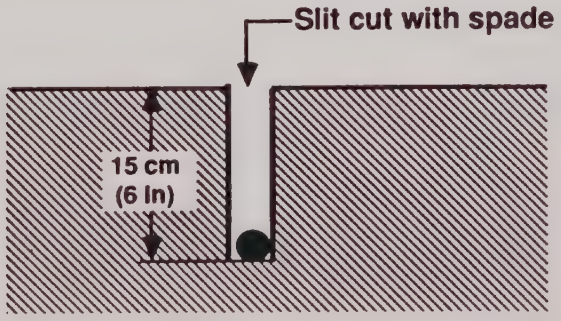
8. Use a grass rake to sweep the excess soil around the trenches back into the ground.

9. Restore the sod to its original state.

10. Repeat the process for the other cable.

Make sure that each cable is buried at a uniform depth of 15 cm (6 in) for the length of each zone.

Cross-section of Soil Burial



## Installing in Gravel

To provide protection from mechanical damage, cables buried in gravel must be surrounded with sand.

**Tools and Equipment**

- sand
- cable burial marker stakes
- fluorescent marker paint
- chalk line
- shovel
- small trenching machine
- tools for installing connectors and terminators or decouplers (see the chapter on Installing the Cable Fittings for details)

**Site Preparation**

1. Ensure that the site plan matches the actual site.

2. Clean debris from the sensor cable paths.

3. Mark the exact cable location on the gravel surface with the fluorescent marker paint. If this is impractical, take measurements from reference points instead.

4. Double-check the location markings against the site plan before burying the cables.

**Installation Procedure**

For burial in gravel, install one cable at a time using the following procedure:

1. Use a small trenching machine to dig a narrow trench 23 cm (9 in) deep.

2. Place an 8 cm (3 in) bed of clean sand in the bottom of the trench. The sand protects the cable from mechanical damage.

3. Lay the cable on the bed of sand. You can hold the cables in place at the bottom of the trench by packing small mounds of sand around the cables at intervals along the route.

4. Check that the white mark on the cable is correctly positioned according to the site plan.

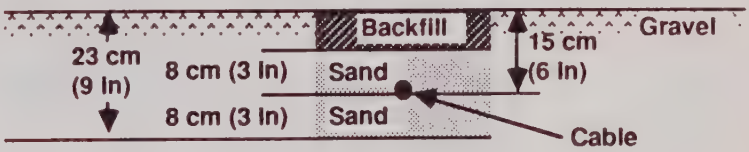
5. Install the terminators or decouplers at the locations indicated on the site plan. Use the procedures given in the chapter on Installing the Cable Fittings.

6. Cover the cable with another 8 cm (3 in) of sand.

7. Backfill to ground level.

8. Remove excess fill from the site.

Cross-section of Gravel Burial



## Installing in Concrete or Asphalt

When installing in concrete or asphalt, place the cables in slots 3.2 cm (1.25 in) deep.

The general procedure for installing cables in concrete or asphalt is to saw the slots, clean the slots, lay the cables, and then seal the cables in the slots. To prevent dirt from getting into the slots, lay the cables and seal them as soon as possible after cleaning the slots. If the cables in a zone are installed in more than one medium, do not seal the cables until after the system is calibrated (see Starting Up and Setting Sensitivity).

**Tools and Equipment**

To install the sensor cables in concrete or asphalt, you need:

- site plan
- electrical interconnection diagram
- tape measure
- spray paint, grease pen, or water-resistant marker, or chalk line and clear lacquer
- concrete saw capable of cutting a slot 1.3 cm (1/2 in) wide. You can mount several diamond-tooth blades side-by-side to cut the 1.3 cm wide slot. It doesn't matter if the slot is wider than 1.3 cm, but it can't be narrower.
- air compressor and hose
- digital multimeter
- pocket knife
- chisel
- heat gun
- electrical tape

**Materials Required**

Obtain the appropriate quantities of the following materials for the installation:

- bond-breaker tape 1.3 cm (1/2 in) wide. When placed on the bottom of the slot, this tape makes a better seal and makes it easier to remove the cable for repair. You can use 1.3 cm (1/2 in) wide masking tape if you wish.

- Dow Corning® 1205 primer (optional). Promotes adhesion of the Dow Corning 888 joint sealant. A hand-pump, garden-type sprayer is required for application of the primer.

- Dow Corning 111 lubricant. Required to lubricate the cable so damage will not occur when the cable expands and contracts.

- Dow Corning 888 Silicone Highway Joint Sealant. Required to seal the sensor cables in concrete and asphalt. You will need approximately 25 liters for every 100 m of cable slot (2 U.S. gal for every 100 ft). (Remember to order enough for two parallel slots.) Sealant comes in pails containing 17 liters (4.5 U.S. gal) each. A silicone sealant pump is required.

- flexible polyethylene foam backer rods (optional). Backer rods prevent the sealant from seeping into cracks and joints. Order backer rods that are 3 mm (1/8 in) wider than the cracks into which the rods will be inserted. Other names for backer rod are green rod, sponge rope, foam rope, and caulking rope.

- PVC pipe with inside diameter at least 1.9 cm (3/4 in) and length 0.9 m (3 ft). If the cables go from slots to trenches, this pipe will protect the cables at the transition points.

## Site Preparation

1. Ensure that the site plan matches the site.

2. Remove grass and debris from the concrete/asphalt in the installation area. Clean out cracks and joints intersecting the slot for approximately 30 cm (12 in) on either side of the slot. Use water under pressure to wash the cracks and joints.

3. Before marking the cable path and sawing the slots, read the applicable information on the following pages:


| Subject | Page |
|---|---|
| Corners | 6-26 |
| Decoupler and Terminator Locations | 6-28 |
| Expansion Joints and Large Cracks | 6-29 |
| Transition from a Slot to a Trench | 6-31 |


4. Mark the sensor cable path on the concrete/asphalt surface with spray paint, grease pen, or water-resistant marker. You can also use a chalk line that is sprayed with clear lacquer. Mark two parallel lines as far apart as the required sensor cable spacing (typically, 1 m or 2 m) (3 ft, 3 in, or 6 ft, 6 in).

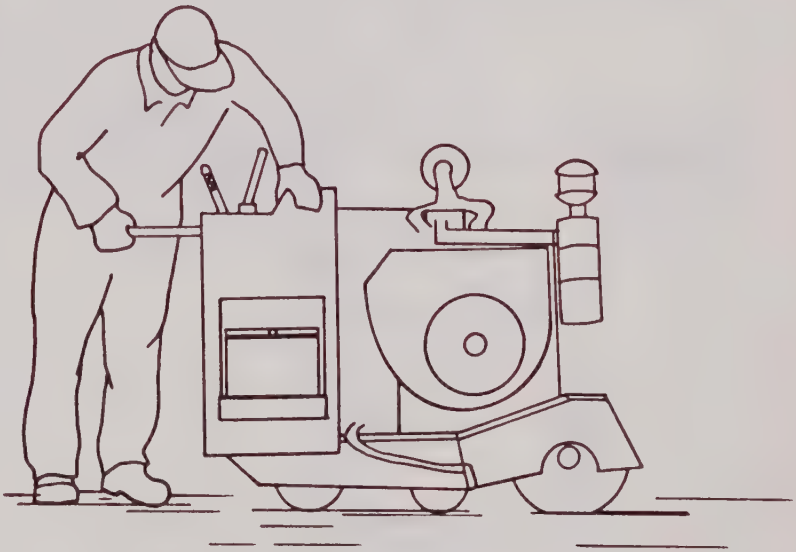
## Sawing Slots

1. Following the marked cable path, cut two parallel slots for the cables with a concrete saw. Make each cut 1.3 cm (1/2 in) wide by 3.2 cm (1.25 in) deep. Make each cut using a single pass of the saw. (You can mount multiple diamond-tooth saw blades side-by-side to make the cut). Check that the slots are 5 cm (2 in) deep and that the bottoms of the slots are fairly smooth.

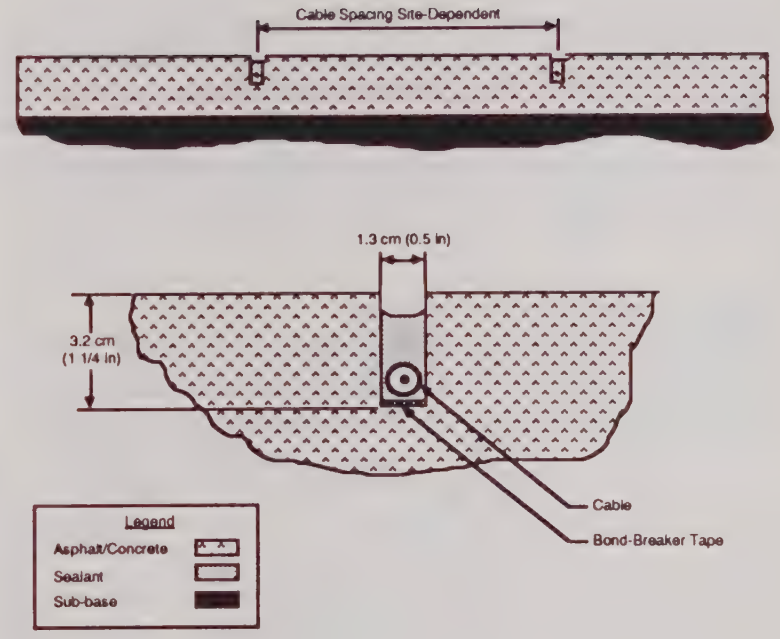
2. Use additional cuts to widen or deepen the slot at decoupler and terminator locations, at expansion joints and large cracks, and at transitions between slots and trenches, as explained on the following pages.

3. Cut slots for lead-in cables to the Panther detection unit. Make the slot 7.5 cm (3 in) deep where the lead-in cable crosses below the sensor cable. Slots for lead-in cables must be at least 2.3 cm (7/8 in) wide to accommodate the ferrite beads.

Using a Concrete Saw

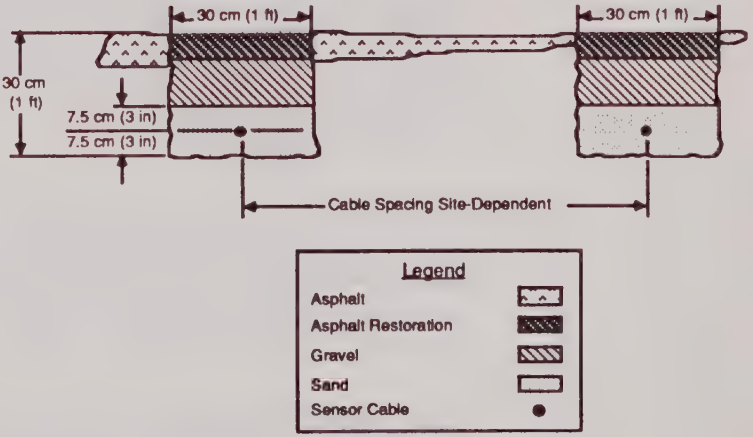


Concrete/Asphalt Slot Dimensions



4. If you cut completely through asphalt, cut two new parallel slots 30 cm (12 in) apart, centered on each original cable slot. Dig up the asphalt to make a trench 30 cm (12 in) deep. Put a 7.5 cm (3 in) layer of sand on the bottom of the trench. Lay the sensor cables on the sand. Put a second 7.5 cm (3 in) layer of sand over the cables. Then fill up the trench with gravel, compact it, and pave over the trenches with new asphalt.

Sensor Cable Installation in Thin Asphalt



## Corners

Corners can be located anywhere within a zone or at the end of a zone. The rules for laying out corners are listed below:

1. Turns should be made as gradual as possible to avoid distorting the detection field. Cut several short, straight slots in which the cables can be turned gradually. Try not to chip or crack the asphalt/concrete.

2. Any number of small turns can be used to make a change in direction, as long as each turn is not more than 30°. For example, a 60° turn can be made in two turns of 30°, with each turn separated by at least 4 m (13 ft). Similarly, a 90° turn can be made in three turns of 30°, with each turn separated by at least 4 m (13 ft).

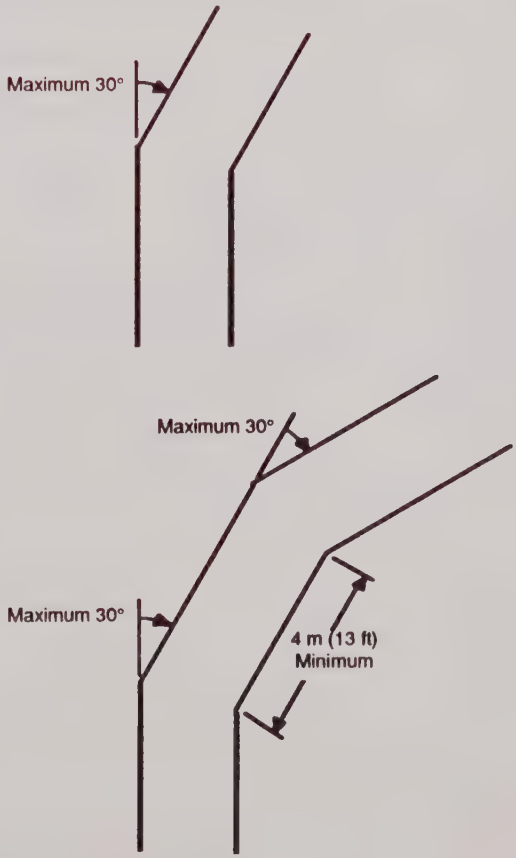
3. Cables must be parallel to each other (the same distance apart) and the same depth around corners. The minimum radius of the inner cable on a corner is 6.1 m (20 ft).

4. If possible, place corners in the center of the slab. Turn corners in the least possible number of slabs.

5. Do not route the cables through existing cracks or expansion joints in the asphalt/concrete. The cable path can cross cracks and joints at any angle greater than 30°, but the cable path cannot traverse cracks or joints at less than 30°.

   The following diagrams show recommended corner layouts for concrete/asphalt.

Cable Path for 0° to 30° Corner



**At Decoupler and Terminator Locations**

Where decouplers or terminators will be installed in asphalt/concrete, widen the slot to 3.2 cm (1.25 in) and deepen it to a depth of 5 cm (2 in) for a length of 61 cm (2 ft).

In countries where there's a big difference between summer and winter temperatures, and where the entire zone is in asphalt/concrete, widen the slot to at least 5 cm (2 in) for a length of 61 cm (2 ft). This will provide room for you to bend the cable at the decoupler or terminator location to provide strain relief.

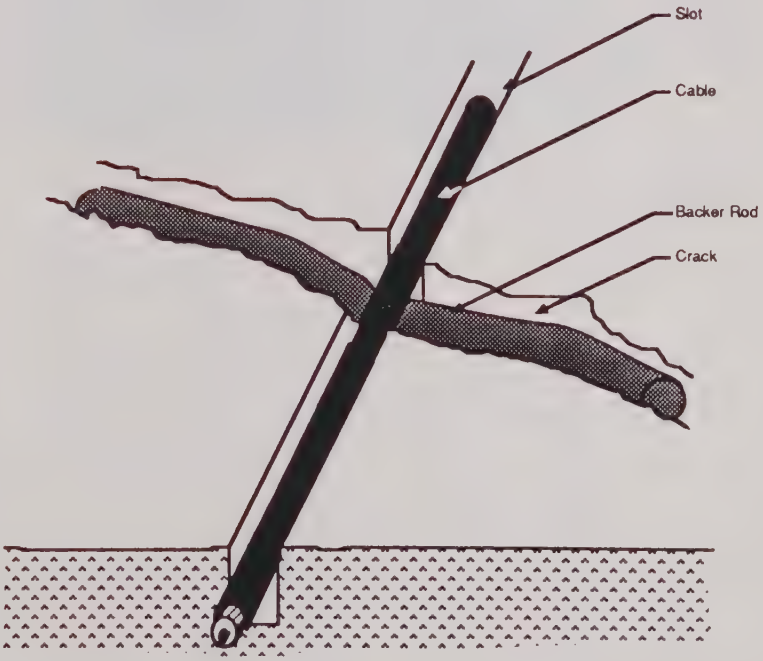
**Expansion Joints and Large Cracks**

At expansion joints and large cracks in the concrete/asphalt, widen the slot to at least 2.5 cm (1 in). Extend this wide slot for 7.5 cm (3 in) on both sides of the joint or crack.

If a crack or joint is deeper than 6.4 cm (2.5 in), insert a flexible polyethylene backer rod for at least 30 cm (1 ft) on either side of the slot. The backer rod's diameter should be slightly larger than the width of the crack or joint. Use a blunt tool to install the backer rod. The backer rod should be at least 6 mm (1/4 in) below the surface of the slot after it is installed.

Do not route the cables through existing cracks or expansion joints in the asphalt/concrete. The cable path can cross cracks and joints at any angle greater than 30°, but the cable path cannot traverse cracks or joints at less than 30°.

Backer Rod at Large Joints and Cracks

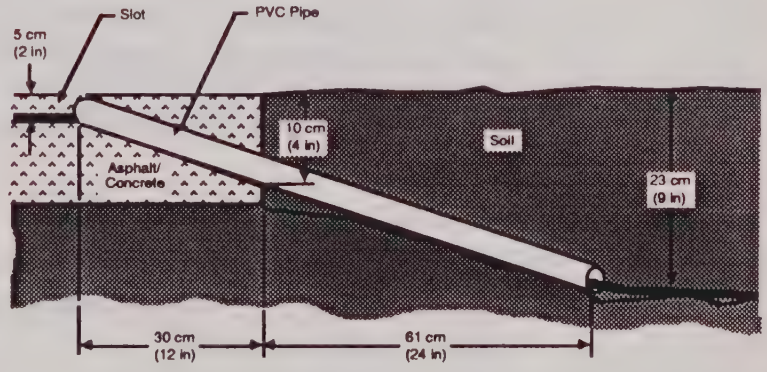


**Transition from a Slot to a Trench**

Follow these instructions if the cable path goes from slots in concrete/asphalt to 23 cm (9 in) slots in soil. At such transitions, the last 30 cm (12 in) of the slot and the first 61 cm (24 in) of the trench should be sloped to meet each other. A 10 cm (4 in) deep cut should result where the different mediums meet.

Enlarge the slot to accommodate a 0.9 m (3 ft) section of PVC pipe centered on the joint. The pipe will protect the cable from damage if the asphalt or concrete shifts.

PVC Pipe at Joint Between Slot and Trench



**Preparation for Laying Sensor Cables**

1. At slot corners, use a chisel to remove sharp edges in the concrete/asphalt that could cut into the cable jacket.

2. Remove debris from the slots, cracks, and joints, and from the area 30 cm (1 ft) on both sides of the slots. Use water under pressure. Clean and dry the area using compressed air. Make sure the sides of the slots are clean. Do not allow dirt or dust to blow into the slots.

3. If desired, apply a thin film of Dow Corning 1205 primer to slots in concrete (but not in asphalt). Apply primer to the slot walls using a garden sprayer. Adjust the sprayer nozzle to coat both walls simultaneously. (Follow the manufacturer's safety instructions when using primer. Wear rubber gloves.) Remove excess primer using compressed air. Allow the primer to dry.

4. Insert bond-breaker tape or masking tape along the bottom of the slot. The tape will make it easier to remove the sensor cable if repairs are necessary.

5. If any sharp rocks that could damage the cable are found in the bottom of the slots, remove them or seal them with Dow Corning 888 sealant.

**Laying the Cables**

1. Unroll the sensor cable beside the slots. Check the cable for flaws. Avoid rough handing that could damage the cable. If damage occurs, refer to the repair information provided in the section on Repairing the Cables, in the Troubleshooting and Repair chapter.

2. Look for the white mark on each cable (it indicates the end of the lead-in cable and the start of the detecting cable). Ensure that the white mark on each cable is correctly positioned according to the site plan. White marks on parallel cables should be within 20 cm (8 in) of each other.

3. Where cables from adjacent zones will be joined with decouplers, overlap the cables by at least 10 cm (4 in).

4. Install ferrite beads on the lead-in cables to the detection unit (refer to the section on Attaching Labels and Ferrite Beads, in this chapter).

5. Check the cables for electrical continuity. Measure the resistance between the center conductor and cable shield with the digitial multimeter to ensure the center conductor is isolated from the cable shield. Next, short the center conductor to the cable shield at one end of the cable, and measure the resistance between the center conductor and the cable shield at the other end of the cable. The meter should indicate a short condition, which means that the continuity of the center conductor and the cable shield are complete.

6. Identify the transmit and receive cables with a temporary means of identification such as tape or paint. The sensor cables on the inside of the perimeter should be receive cables, and the cables on the outside of the perimeter should be transmit cables. Permanent labels, shipped with the cable sets, will be affixed when the cables are connected to the detection unit.

7. Install the decouplers and terminators (see Installing the Cable Fittings for details).

8. Where the cable passes from a slot to a trench, fit a 0.9 cm (3 ft) piece of PVC pipe over the cable. (You can slit the pipe lengthwise and then slip it around the cable.) The pipe will protect the cable from damage.

**Sealing Cables**

1. If the cables in a zone pass through more than one medium (for example, from soil to asphalt to concrete), connect the detection unit and perform a walk test before sealing the cables. It may be necessary to put ferrite beads on the portion of the cable passing through asphalt if the detection field is too sensitive in that area. (Refer to the chapter on Starting Up and Setting Sensitivity for details).

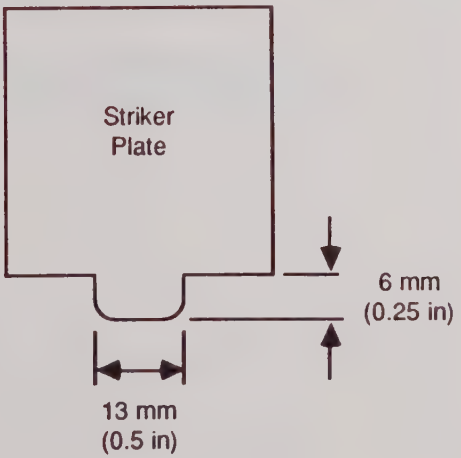
2. Grease the portion of the cable that passes through asphalt or concrete with Dow Corning 111 lubricant. Where the cable crosses a crack or joint, use extra lubricant for 30 cm (1 ft) on both sides of the crack or joint. This will allow the cable to slide in the sealant if the installation medium expands or contracts.

3. Lay the cable in the slot. You may have to pull on the cable so it will lie flat. However, do not stretch the cable!

4. Pump Dow Corning 888 sealant into the slot. The slot must be clean and dry. For best results, the air temperature should be at least 4° C (40° F). Sealant should be installed within one hour of applying the 1205 primer. Pump the sealant from the drum or from a pail using an air-powered pump. Fill the slot to 6 mm (1/4 in) below the pavement surface. If desired, you can slide a striker plate (such as the one illustrated below) along the slot to mold the sealant to the required depth.

   Apply sealant to cracks and joints for at least 30 cm (12 in) on either side of the slot. Remove excess sealant from the pavement surface.

Striker Plate for Molding Sealant to Proper Depth



## Finishing Up

1. If desired, treat the concrete along the cable path with waterproofing sealant such as Chem-Trete BSM. Follow the manufacturer's instructions.

2. Route the cables into the detection unit. Test the cables for resistance.

3. Keep any unused cable. Indicate its location on the original roll and mark it as detecting or lead-in cable. If you require a section of cable for splicing later, you will need to know whether the piece is detecting or lead-in cable.

## Installing an Overlap

If you're installing a two-zone, decoupled system, make sure the sensor cables are properly laid out in the field-start overlap area. This overlap area:

- allows the detection field in each zone to build up to full strength
- provides overlapping, full-strength coverage

The overlap area is:

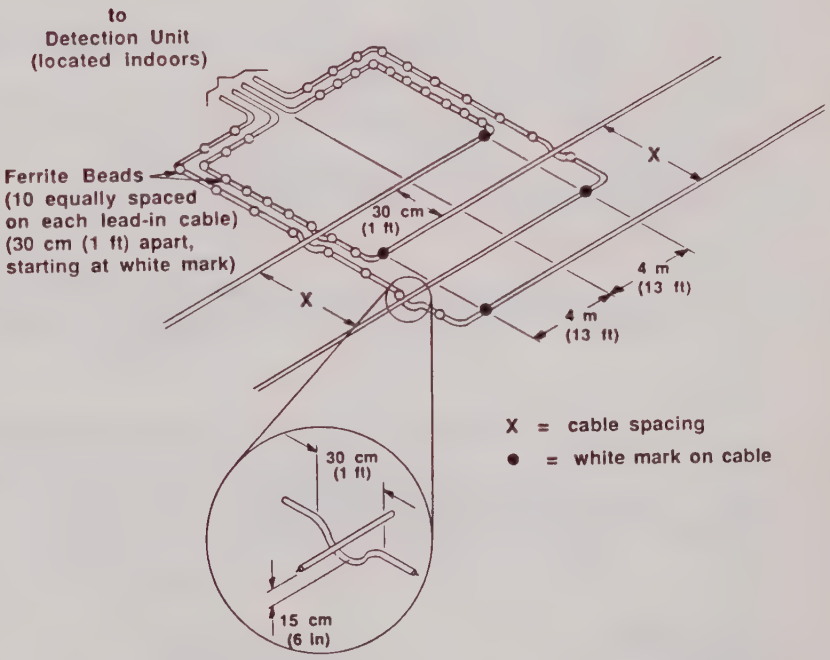
- 8 m (26 ft) long
- 1.5 m (5 ft) wide

Make sure there is enough room for the overlap to be installed.

**8 m Detection Field Overlap**

Place the white marks of each zone 8 m (26 ft) apart at the overlap, to ensure that the detection fields of both zones will overlap 4 m (13 ft) to provide effective coverage.

Detection Fields Overlapping for Full Protection




The cables cross over each other at the overlap. When crossing over cables:

- cross the cables at 90°
- ensure a vertical separation of at least 15 cm (6 in) where the cables cross over each other
- ensure leaky (detecting) cable crosses over lead-in cables

# Creating Areas of No Detection

**What is a Bypass?**

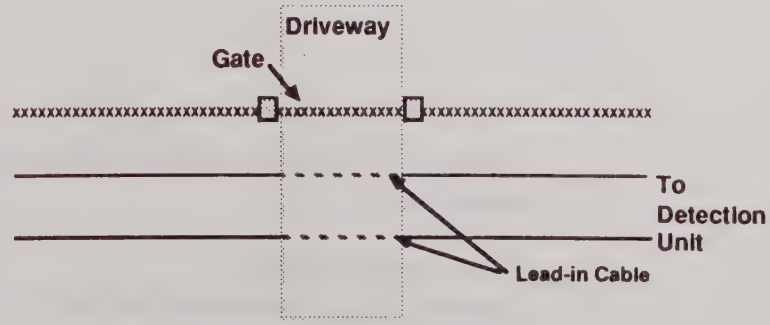
A bypass is a non-detecting section within an active zone. It's used:

- where obstacles close to the sensor cable route cause false detection
- where an area of no detection is desired (a guarded gate, for example)
- to cross a fence boundary

A bypass can be created in the middle of an active zone by splicing in lead-in cable in place of the normal transmit and receive cables.

This lead-in cable can be from the unused portion that you cut off when you install the detection unit, or it may be ordered separately (Order #: SP-100022-00).

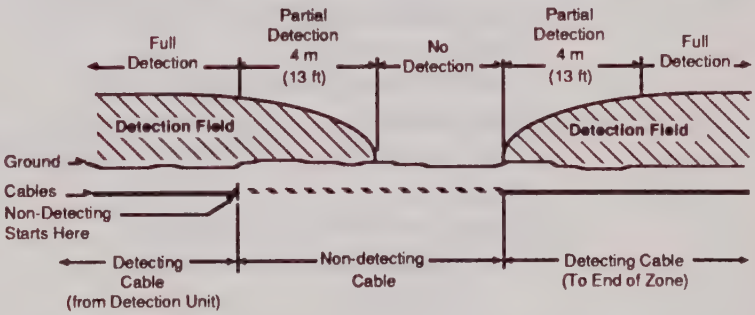
Lead-in Cable Spliced in to Create Bypass



**Areas of Partial Detection**

The detection field takes about 4 m (13 ft) to dissipate at the start of a bypass and 4 m (13 ft) to regain full strength after the end of a bypass. Make sure you allow for these two areas of partial detection in your installation design.

Partial Detection at Start and End of Bypass




**Note**: If you're installing a bypass in concrete, asphalt or light soil, allow at least 8 m (26 ft) for the detection field to dissipate if there are large moving objects or fences nearby.

Save yourself time and money by:

- locating the detection unit so the normal lead-in sensor cable can be used for the bypass
- routing the cables so the zones end at either side of the bypass area

**Tools and Equipment**

To install a bypass you need:

- four male and four female Panther TNC connectors
- forty ferrite beads with retainers
- two pieces of lead-in cable, the length of the bypass
- four pieces of Panther shrink tubing
- one roll of putty tape
- one cable preparation kit
- Panther crimp tool
- Panther coaxial cable stripping tool
- side cutters
- heat gun with extension cord (in damp locations)
- ohmmeter
- female to female TNC adapter
- TNC/Banana plug adapter cable

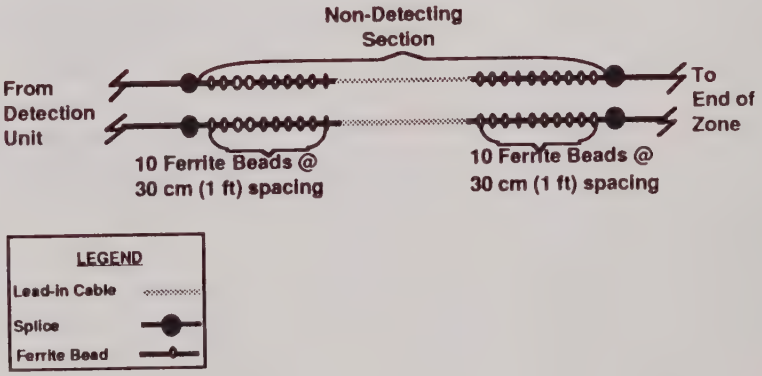
**Bypass Installation Procedure**

1. Cut out and discard a piece from both the transmit and receive cables that is as long as the bypass area. Do not splice in a section of lead-in cable without first removing an equal length of detecting cable at the splice location.

2. Cut the two pieces of lead-in cable approximately to length. Allow some extra length for strain relief.

3. Slide ten ferrite beads onto each end of both pieces of lead-in cable.

Sliding Ferrite Beads onto Cable




4. Use the retainers to fasten the ferrite beads in place, 30 cm (1 ft) apart, starting 30 cm (1 ft) from the cut ends of the lead-in pieces.

5. Install connectors on one active zone cable and the corresponding lead-in piece. Use an ohmmeter and a TNC/Banana plug adapter cable to test for shorts.

6. Join the connectors, and use the putty tape and shrink tubing to waterproof the assembly.

7. Do the three remaining connections in turn.

Refer to the section on Repairing Cables in the Troubleshooting and Repair chapter for more information on splicing and waterproofing cables.

## Running Lead-in Cable Indoors

Make sure you've found a suitable location for the detection unit before you run the lead-in cable inside the customer's building. Lead-in cable is non-detecting cable so you can place it inside conduit without affecting the operation of the system. Conduit will help you pass the cables through the building, but it's not essential that you use it.

**Tools and Equipment**

- wood drill
- concrete drill (if required)
- conduit
- electrical tape
- fish tape (if required)
- tacking gun or cable tacks

**Installation Procedure**

To pass the lead-in cable through the customer's building to the detection unit, use the following procedure:

1. Locate and mark the desired entrance area.

2. Drill a hole large enough for four sensor cables and a multi-conductor cable (for power, alarm contacts, etc.).

3. Install exterior conduit if desired.

4. Install interior conduit if desired.

5. Tape the ends of the four sensor cables together.

6. If required, feed the fish tape from the detection unit to the exterior. Fasten the sensor cables to the fish tape.

7. Feed the sensor cables to the interior.

8. Route the sensor cables to the detection unit location and install cable tacks where required. If you accidentally pierce the cable jacket, repair it immediately using the recommended procedure in the Troubleshooting and Repair chapter of this handbook.

9. Leave sufficient slack in the cable to allow you to repair the cable if you run into any connector problems (i.e., leave a service loop).

# Installing the Detection Unit

# Installing the Detection Unit


| | |
|---|---|
| Mounting the Detection Unit | 7-1 |
| Connecting Other Devices | 7-8 |
| Using the Terminal Strip | 7-11 |
| Selecting Line Supervision | 7-18 |
| Installing Output Supervision | 7-21 |
| Installing Input Supervision | 7-29 |
| The Option Selection Switch | 7-34 |
| Making Final Connections | 7-38 |

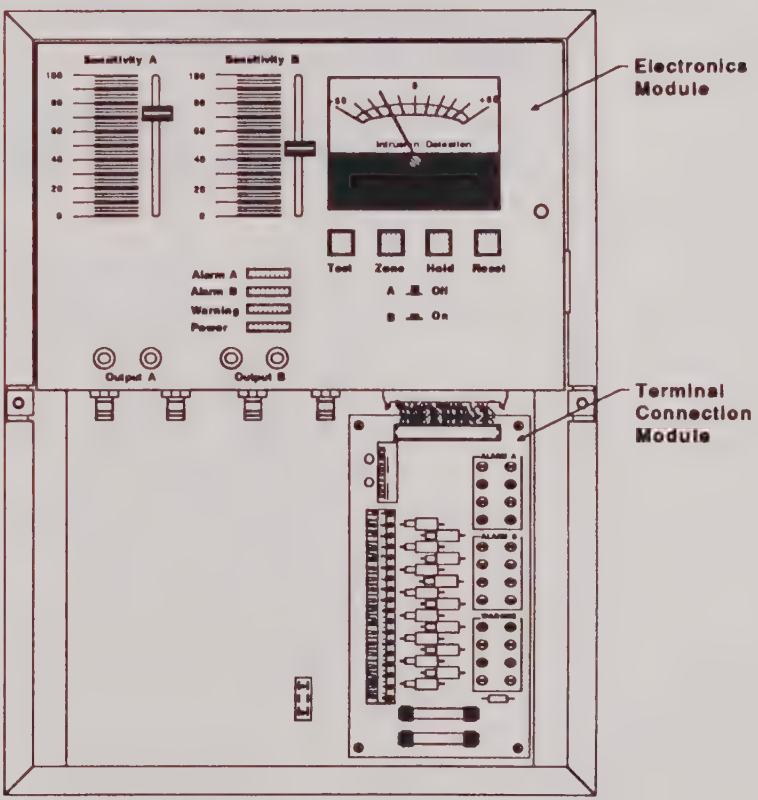
# Mounting the Detection Unit

The detection unit must be mounted indoors, inside the customer's building. Make sure that:

- the temperature stays within the range 0°-50°C (32°-122°F)
- 12 Vdc ±15% @ 500 mA power is available

The detection unit is shown below.

Panther Detection Unit



**Tools and Equipment**

To mount the detection unit, you need the following:

- load set (for a single-zone system only)
- drill with extension cord
- screwdriver
- tools for installing connectors (see the chapter on Installing the Cable Fittings)
- a copper ground rod 1 cm (3/8 in) in diameter and at least 1.2 m (4 ft) long

**Mounting Procedure**

1. Unpack the detection unit pieces from the shipping carton. Don't assemble the pieces yet. Make sure you have:

   - the detection unit housing
   - the electronics module
   - the terminal connection module
   - 15 m (49 ft) of #16 ground wire with a female terminal on one end
   - the parts kit

2. The wiring can run into the housing through the knockouts on the bottom or the back of the housing. The knockouts are circular indentations that are punched out to create holes in the housing. The remainder of this procedure describes an installation using the bottom knockouts.

3. Locate the two knockouts on the bottom of the housing. Each knockout has two sections, an inner one for creating a small hole, and an outer one for creating a large hole. Remove both sections of the left knockout. This leaves a large hole. Remove only the inner section of the right knockout. This leaves a small hole. Fasten the bushings from the parts kit to the holes. The large bushing is for the sensor cables. The small bushing is for the alarm panel connections and any other wiring.

4. Hold the detection unit housing against the wall in its intended location and mark the upper mounting holes. Set the housing aside.

5. Drill holes for the top two mounting screws. The screw package in the parts kit includes masonry anchors and a drill-size chart.

6. Install the screws, but leave them projecting 3 mm (1/8 in) out from the wall. Use the supplied anchors, if necessary. Hang the detection unit housing on the screws.

7. Mark the locations of the bottom holes on the wall and remove the housing. Drill holes for the bottom two screws.

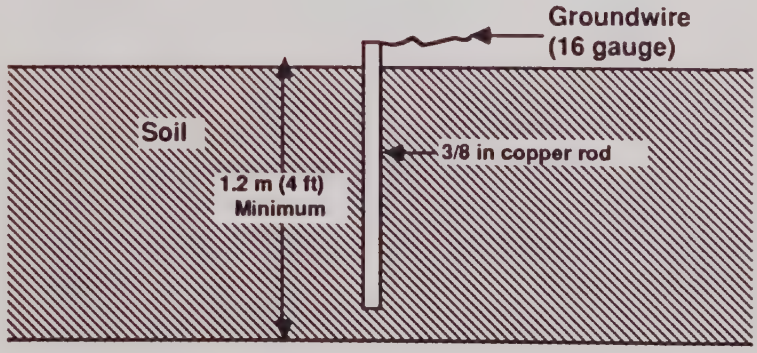
8. Rehang the housing, install the bottom screws, and tighten all four screws.

9. The detection unit must be adequately grounded to allow its lightning protection components to function properly. Follow these rules:

   - Use buried ground rods (earth ground).
   - Don't use the utility (power) or ac or dc grounds.
   - Use the #16 ground wire supplied with the detection unit.
   - Keep the ground wire as short and direct as possible. Avoid loops or turns.
   - Avoid induced currents. Keep the ground wire away from other cables or wires, especially the lead-ins from outdoor antenna wires.

   Drive the ground rod into the earth. Connect the ground wire to the ground rod.

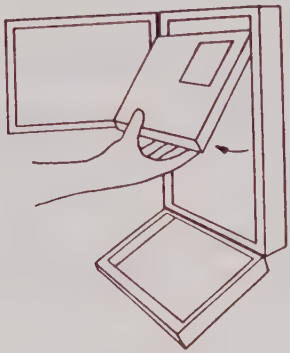
Ground Wire Connected to Ground Rod




10. Feed the ground wire through the small bushing and push the female connector onto one of the three ground terminals inside the housing.

11. Snap the electronics module into place. Attach the sensor cables and the ribbon cable.

Installing Electronics Module in Housing



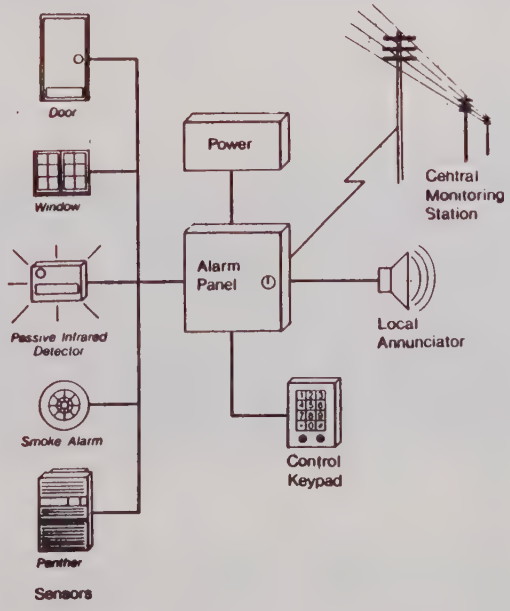
# Connecting Other Devices

For proper operation, Panther requires:

- a 12 Vdc ± 15% 500 mA power supply (with battery backup if required)
- an alarm panel or annunciator

In addition to the required devices, Panther can also work in conjunction with other types of sensors and other devices commonly used in security systems.

Sensors and Annunciators



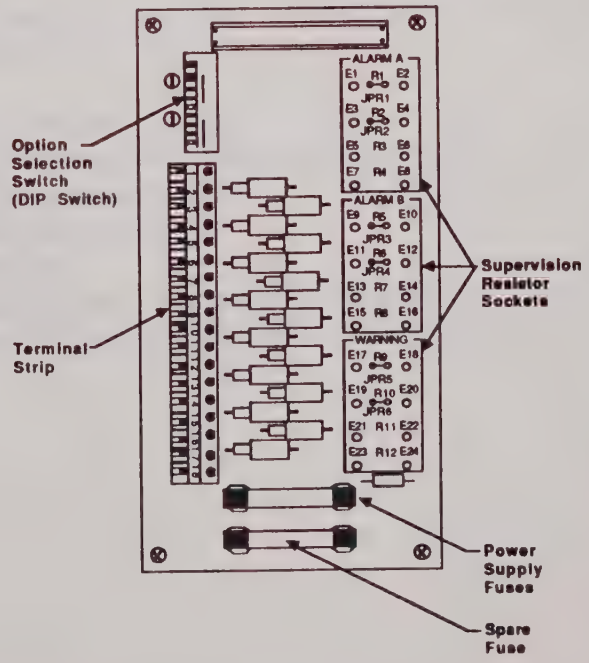
## Terminal Connection Module

All connections to other devices are made via Panther's terminal connection module.

The terminal connection module has:

- an eighteen-position terminal strip for external connections
- twelve supervision-resistor mounting sockets
- a ten-position option selection switch (DIP switch)
- a replaceable power supply fuse (3/4 A fast blow 3AG type; Littlefuse P/N 312.750, Buss P/N AGC 3/4 A, or equivalent)
- spare fuse

Components of Terminal Connection Module



## Alarm Panels

If the site you're installing requires alarm processing capabilities, you will have to connect Panther to an alarm panel.

Panther is designed to interface easily with a wide variety of alarm panels. There are many different ways that Panther can be connected to an alarm panel.

Alarm panels are connected to the terminal strip on the terminal connection module. If your alarm panel requires supervision (end-of-line) resistors, you can plug resistors into the sockets located on the terminal connection module. The next sections tell you how to use the terminal strip and the supervision resistor sockets.

# Using the Terminal Strip

## Alarm Types

Panther generates two types of alarms:

- sensor
- warning

Sensor alarms are generated whenever someone crosses the cables. This type of alarm is output at the Alarm A and Alarm B terminals on the terminal strip.

Warning alarms are generated whenever one or more of the following occurs:

- Panther's top door is opened
- the box that houses the Panther enclosure is opened
- fault with the transmit cable
- fault with the receive cable
- sensor failure
- remote input line (Test, Reset or External Tamper) is cut
- input supply voltage falls outside the range of 10.2 to 13.8 Vdc

See the chapter on Troubleshooting and Repair for more information on these alarms.

Warning alarms are output at the Warning terminals on the terminal strip. However, you can change the way warning alarms are output by using the option selection switch. See the section on The Option Selection Switch, in this chapter, for more information.

## Terminal Strip Assignments

The terminal strip provides connections for:

**Ouputs:**

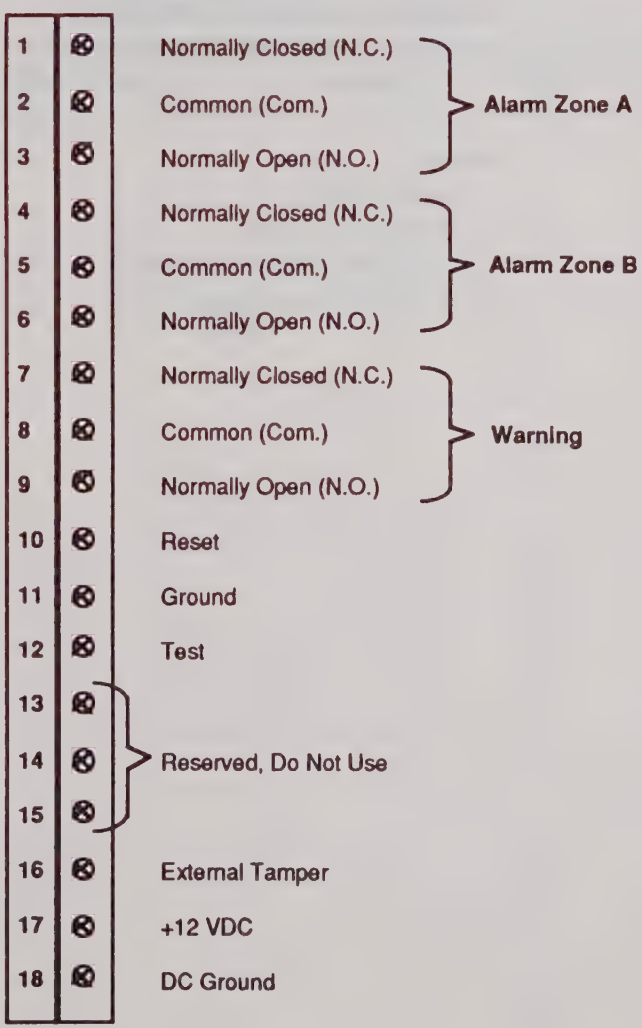
- zone A alarm (form C relay output)
- zone B alarm (form C relay output)
- warning alarm (form C relay output)

**Inputs:**

- a remote reset input
- a remote test input
- an external tamper switch input
- the 12 Vdc power supply input

The unassigned terminals are reserved for future expansion and must not be used.

Input and Output Connections



## Outputs

Panther provides three alarm outputs:

- zone A alarm
- zone B alarm
- warning alarm

Each of the outputs has a form C relay with the following connections:

- normally closed (N.C.)
- common
- normally open (N.O.)

Note the following electrical characteristics:

- Each alarm output is rated for an 4VA resistive load. DO NOT exceed either 16 Vdc or 0.25 A.
- Each alarm output is completely isolated from all of the others. In particular, the common leads are not tied together, or tied to the dc ground.
- To provide fail-safe operation, the relays are energized under normal conditions. Loss of power causes an alarm condition. The N.C. and N.O. designations refer to the state of the relays under normal (no alarm) conditions when power is on.
- Supervision resistors can be inserted into the output circuitry by using the supervision resistor sockets (see the section on Installing Output Supervision, in this chapter).

## Inputs

Panther provides remote Test and Reset input terminals, and a terminal for the connection of an external tamper switch.

Panther provides input supervision on:

- remote Test
- remote Reset
- external tamper

For more information on input line supervision see the section on Installing Input Supervision, in this chapter.

## Making Connections

To make connections to the terminal strip, perform the following procedure:

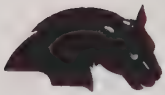
1. Feed the power and signal lines into the detection unit through the small bushing.

2. Unpack the terminal connection module.

3. Install supervision resistors for output supervision, if required. See the section on Installing Output Supervision for more information.

4. Connect the power and signal lines to the terminal strip.

5. Align the four holes at the corners of the terminal connection module with the four standoffs mounted in the lower right section of the housing. Push firmly into place.



## Selecting Line Supervision

Supervision (end-of-line) resistors are used to provide an extra level of security in some alarm systems. Supervision resistors are recommended for installations where:

- signal lines connecting Panther to an alarm panel are vulnerable to damage or sabotage
- remote Test, Reset or External Tamper lines are vulnerable to damage or sabotage

There are two kinds of line supervision that you can select:

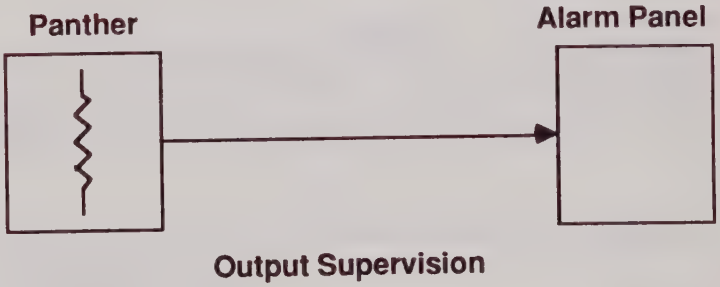
- output supervision
- input supervision

## Output Supervision

Output supervision provides a known, fixed resistance on an alarm line for the alarm panel electronics to measure. A change in the resistance indicates:

- an alarm condition has been detected, and a relay contact has been activated
- the line has failed
- someone has cut the line
- someone has shorted the line

Output Supervision - from Panther to Alarm Panel



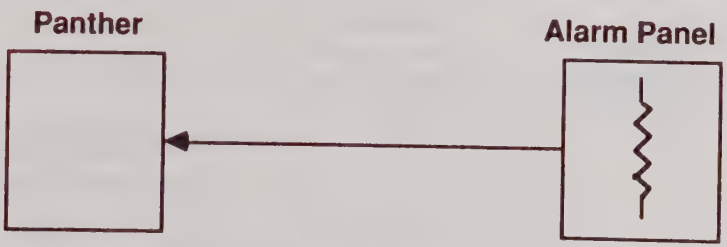
## Input Supervision

Panther provides built-in supervision on three remote terminals:

- Test
- Reset
- External Tamper

Resistors are installed in the alarm panel. They provide a fixed resistance on the input lines for Panther to measure. A change in resistance indicates that the line has been cut or activated.

Input Supervision - from Alarm Panel to Panther




**Input Supervision**

The following two sections describe installation procedures for output and input supervision.

# Installing Output Supervision

Panther doesn't require any supervision resistors for proper operation. However, the alarm panel you're using may require supervision resistors for all sensor lines. If you need to install supervision resistors, determine the values for these resistors from the instructions packaged with the alarm panel.

## How Supervision Works

The basic idea behind output supervision is to provide a known, fixed resistance on an alarm line for the alarm panel electronics to measure. A change in the resistance indicates one of the following:

- an alarm condition has been detected, and a relay contact has been activated
- the line has failed
- someone has cut the line
- someone has shorted the line

**Supervison Resistor Schemes**

There are several supervision schemes. Simple schemes can provide a way to detect one of the conditions listed above and raise an alarm. More complex supervision schemes can differentiate between all of the conditions and provide more information to security personnel.

The schemes are classified as:

- single-resistor schemes (in series or parallel)
- dual-resistor schemes (in series and parallel)

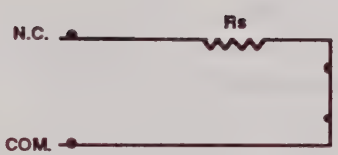
Since each alarm provides both an N.O. and an N.C. contact, there are four recommended variations:

- single resistor, in series, N.C.
- single resistor, in parallel, N.O.
- dual resistor, N.C.
- dual resistor, N.O.

N.C. = Normally Closed
N.O. = Normally Open

The simple diagrams on the next page show how the various supervision schemes are wired and the kinds of faults they can detect.

Single Resistor, in Series, Normally Closed




| Possible Values | Meaning |
|---|---|
| Rs | Normal |
| 0 ohms | Line short (fault) |
| Infinite | Alarm or line open |

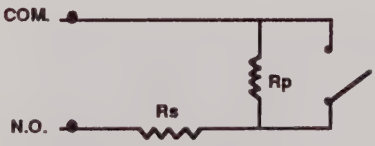
Single Resistor, in Parallel, Normally Open

| Possible Values | Meaning |
|---|---|
| Rp | Normal |
| 0 ohms | Alarm or line short (fault) |
| Infinite | Line open (fault) |

Dual Resistor, Normally Closed

| Possible Values | Meaning |
|---|---|
| Rs | Normal |
| Rs + Rp | Alarm |
| 0 ohms | Line short (fault) |
| Infinite | Line open (fault) |

Dual Resistor, Normally Open




| Possible Values | Meaning |
|---|---|
| Rs + Rp | Normal |
| Rs | Alarm |
| 0 ohms | Line short (fault) |
| Infinite | Line open (fault) |

Two other variations are:

- single resistor, in series, N.O.
- single resistor, in parallel, N.C.

The first variation cannot detect an open line fault. The second cannot detect a shorted line fault. For these reasons they are easiest to sabotage, and are therefore not used.

Single Resistor, in Series, Normally Open

| Possible Values | Meaning |
|---|---|
| infinite | Normal or line open (fault) |
| Rs | Alarm |
| 0 ohms | Line short (fault) |

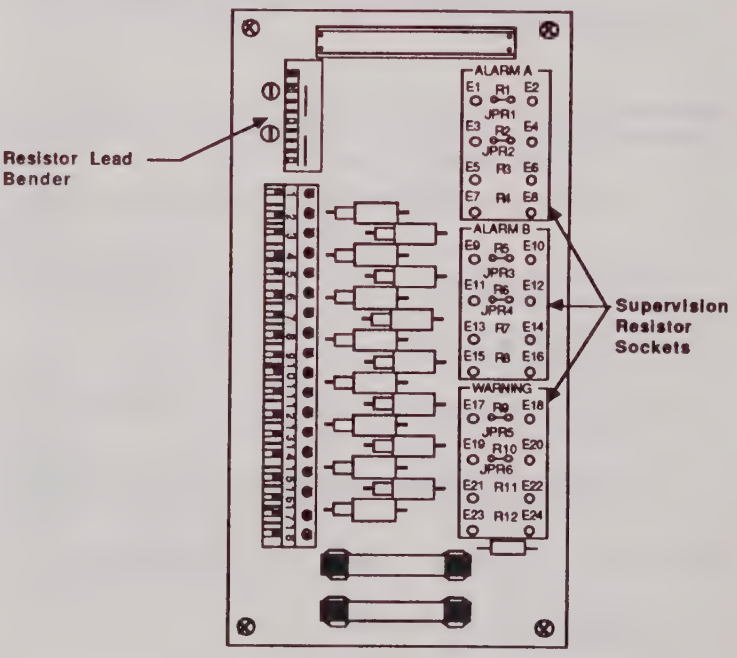
Single Resistor, in Parallel, Normally Closed

| Possible Values | Meaning |
|---|---|
| 0 ohms | Normal or line short (fault) |
| Rp | Alarm |
| infinite | Line open (fault) |

## Using the Sockets

The terminal connection module has solderless sockets designed to accept supervision resistors. The sockets are part of the circuitry for the alarm outputs on the terminal strip. There are four sockets provided for each of the three alarm outputs. The sockets are labeled R1, R2, ..., R12.

Location of Supervision Resistor Sockets

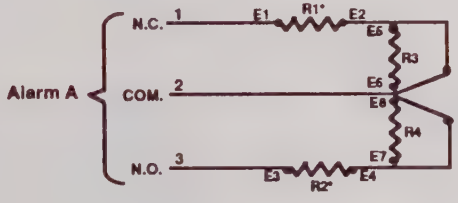


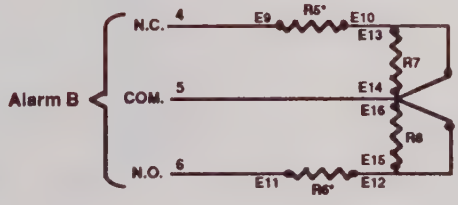

Since supervision resistors aren't required for normal operation, the series resistor sockets (R1, R2, R5, R6, R9, R10) are shorted with wire jumpers at the factory. Before you insert a resistor into one of these sockets, clip out the wire jumper. These sockets must be filled with either jumpers or resistors. Do not leave them empty. Use the resistor-lead bender mounted on the module to simplify resistor installation.

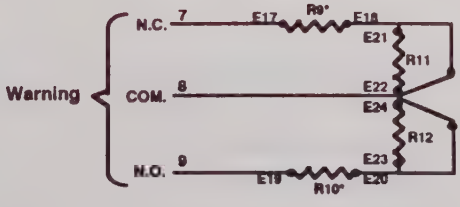
The schematics below can help you determine which sockets to fill for your supervision scheme. Obtain the values of the resistors from the instructions provided with the alarm panel you are using.

If you want a specific supervision scheme to be configured, refer to the detailed schematics on page 7-27.

Schematics for Supervision



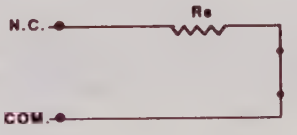




* If not present, replace with a jumper

A more detailed diagram of the same schematics is also provided:

Detailed Schematics




Alarm A - Replace JPR1 with R1 (E1 and E2)

Alarm B - Replace JPR3 with R5 (E9 and E10)

Warning - Replace JPR5 with R9 (E17 and E18)

Alarm A - Install R4 (E7 and E8)

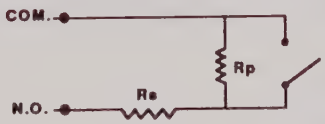
Alarm B - Install R8 (E15 and E16)

Warning - Install R12 (E23 and E24)

Alarm A - Replace JPR1 with R1 (E1 and E2); Install R3 (E5 and E6)

Alarm B - Replace JPR3 with R5 (E9 and E10); Install R7 (E13 and E14)

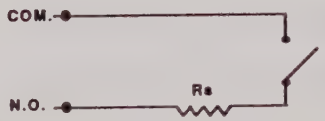
Warning - Replace JPR5 with R9 (E17 and E18); Install R11 (E21 and E22)




Alarm A - Replace JPR2 with R2 (E3 and E4); Install R4 (E7 and E8)

Alarm B - Replace JPR4 with R6 (E11 and E12); Install R8 (E15 and E16)

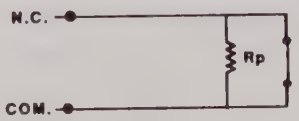
Warning - Replace JPR6 with R10 (E19 and E20); Install R12 (E23 and E24)




Alarm A - Replace JPR2 with R2 (E3 and E4);

Alarm B - Replace JPR4 with R6 (E11 and E12);

Warning - Replace JPR6 with R10 (E19 and E20);




Alarm A - Install R3 (E5 and E6)

Alarm B - Install R7 (E13 and E14)

Warning - Install R11 (E21 and E22)

**Trouble-shooting**

If the level of resistance indicates an alarm, (i.e., an intrusion in the detection field), the corresponding alarm light on Panther and any alarm annunciators on the alarm panel should be activated.

Panther will not warn you if an output supervision fault is detected (i.e, a short or open line); this should be handled by your alarm panel.

# Installing Input Supervision

Panther provides built-in supervision on three remote terminals:

- Test
- Reset
- External tamper

**How Supervision Works**

Resistors are installed in the alarm panel, and provide a fixed resistance on the remote input lines for Panther to measure. The resistance value must be 2.2 kΩ ± 5%, measured on the detection unit, for all input lines.

A change in resistance indicates that the supervised line has been cut or activated.

**Supervision Scheme**

The supervision scheme used is classified as:

- single resistor, in parallel, Normally Open

Unlike output supervision, you don't have a choice of supervision schemes.

**Activating Remote Test**

The test feature allows you to attach a remote Test switch to Panther. When you press this switch, Panther's alarm indicators and relays are activated for 3 seconds. To activate this feature, connect wires from the switch to terminal 12 (Test terminal) and terminal 11 (common ground) on the terminal strip.

**Installing Supervision on Test Line**

If you want the line to be supervised, perform the following steps:

1. Install a resistor (value 2.2 kΩ ± 5%) in the alarm panel. Refer to the instructions provided with your alarm panel.

2. Disconnect the power from the electronics module. Disconnect the sensor cable and the ribbon cable from the electronics module.

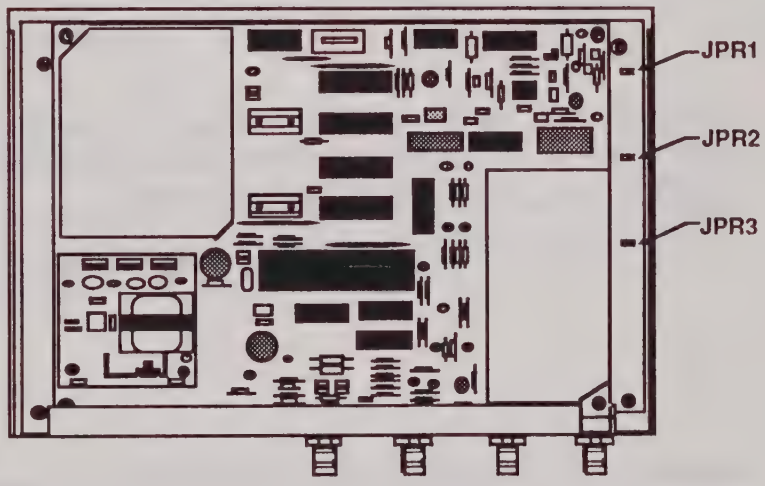
3. Place your hand underneath the Tx and Rx connectors and grasp the bottom of the electronics module.

4. Unsnap the bottom of the electronics module from the housing by pulling firmly.

5. Swing the electronics module out and downward to remove it from the housing.

6. Turn the module over. Note the three jumpers located on the back, right-hand side as indicated below:

Location of Jumpers on Electronics Module




7. Pull off the second jumper (JPR2). This enables the supervision feature.

8. Replace the electronics module in the housing. Snap the electronics module back into position, and replace the sensor cables and the ribbon cable.

**Activating Remote Reset**

The reset feature allows you to attach a remote Reset switch to Panther. To activate this feature, connect wires from the switch to terminal 10 (Reset terminal) and terminal 11 (common ground) on the terminal strip.

**Installing Supervision on Reset Line**

If you want the line to be supervised, perform the same procedure as outlined in the above section (Installing Supervision on Test Line), with the following change:

- In step 7, remove the **third** jumper (JPR3), to activate line supervision.

**Activating External Tamper**

The external tamper feature allows you to provide an extra level of protection for the Panther unit. You can place the Panther unit in a box or a room that is connected to an external tamper switch (e.g., door contact closure). This switch should be a normally closed switch (electrical contacts are closed when the enclosure door is open). If someone attempts to access the Panther unit, the external tamper switch activates a tamper alarm.

To activate the external tamper feature, connect wires from the normally closed switch to terminal 16 (External tamper terminal) and terminal 11 (common ground) on the terminal strip.

### Installing Supervision on External Tamper Line

If you want the line to be supervised, perform the same procedure as outlined in above section (Installing Supervision on Test Line), with the following change:

- In step 7, remove the **first** jumper (JPR1), to activate line supervision.

### Trouble-shooting

For information on troubleshooting input supervision faults, refer to the section on Solving Input Supervision Faults, in the Troubleshooting and Repair chapter.

## The Option Selection Switch

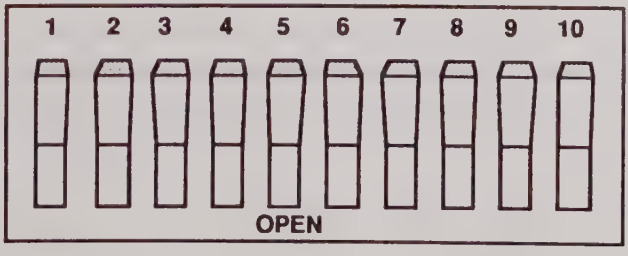
The option selection switch allows you to:

- combine alarm types
- enable or disable warning alarms associated with Panther's top door (internal/external tamper alarms)
- determine the type of analog output coming from Panther's Output jacks
- select the detection velocity
- select frequencies

See page 7-9 for the location of the option selection switch.

The standard settings for the ten-position option selection switch are shown in the illustration below. Note that all switches are set to the OPEN position when the terminal connection module is shipped from the factory.

DIP Switch Factory Settings



Option Selection Switch Functions

The function of each switch on the option selection switch is shown in the table below.

| Switch | Position | Function |
|---|---|---|
| 1 | Open | Normal |
| | Closed | Diagnostics Mode |
| 2, 3, 4 | 2 3 4 | OUTPUT SELECTION |
| (O=Open) | O O O | (Normal position) |
| (C=Closed) | O O C | Factory Test only |
| | O C O | Factory Test only |
| | O C C | 1 V reference output |
| | C O O | 0 V reference output |
| | C O C | Factory Test only |
| | C C O | RESERVED |
| | C C C | RESERVED |
| 5 | Open | Warning alarms are annunciated independently of sensor alarms |
| | Closed | Warning alarms are included with sensor alarms |
| 6 | Open | Internal/External tamper switch is enabled |
| | Closed | Internal/External tamper switch is disabled |
| 7 | always Open | RESERVED |
| 8 | | DETECTION VELOCITY |
| | Open | Detection velocity 0.04 to 8 m/s |
| | Closed | Detection velocity 0.02 to 8 m/s |
| 9, 10 | 9 10 | FREQUENCY SELECTION* |
| (O=Open) | O O | F1 |
| (C=Closed) | C O | F2 |
| | O C | F3 |
| | C C | Off |

* This feature is available for units with serial numbers #5000 or greater. See the section on Solving False Alarms, in the Troubleshooting and Repair chapter, for more information on frequency selection.

## Diagnostics

Panther provides built-in diagnostics, in which the four indicator lights and the Zone switch are used to specify various alarm conditions.

To access Panther's diagnostics, close DIP switch 1.

## Combining Alarms

Panther generates two kinds of alarms:

- sensor alarms that are generated when the detection field is disturbed
- warning alarms that occur whenever Panther's door is opened or a system fault is detected

Switch 5 makes a warning alarm equal to a sensor alarm. In other words, the same kind of alarm is generated whether the door is opened or a system fault is detected or an intrusion is detected. This feature is supplied so a warning alarm can be annunciated even if you haven't used a warning alarm output on the Panther terminal strip. When switch 5 is closed, a warning alarm is output at the Alarm A and Alarm B terminals.

**Enabling/ Disabling Tamper Alarms**

Switch 6 disables the warning alarms generated by the tamper switch. This feature is especially useful during system testing when you wish to operate Panther with the external housing door and the detection unit door open.

**Reserved Switch**

Switch 7 is reserved for future use and must always be left in the open position.

**Detection Velocity**

When DIP switch 8 is in the open position, the detection unit can detect intruders crossing the detection field at speeds of 0.02 to 8 m/s (0.07 to 26 ft/s).

If you set switch 8 in the closed position, the detection unit can detect intruders crossing the detection field at speeds of 0.04 to 8 m/s (0.14 to 26 ft/s). The closed setting reduces the possibility of nuisance alarms caused by rain and subsurface water, but still ensures the detection of slow-moving intruders.

## Making Final Connections

Once you've installed any required supervision resistors, made all of your connections to the terminal strip and set the option selection switch, you can finish installing the detection unit by carrying out the following procedure:

1. Attach the ribbon cable to the electronics module. Ensure that the retention clips at each end of the connector are fastened.

2. Feed the lead-in cables into the detection unit through the large bushing.

3. Before you cut the cables to length:

   - leave a 2 m (6 ft, 6 in) coil as a service loop outside the housing
   - re-label the cables if trimming them to length will cut off the existing labels

4. Install the TNC male connectors on the sensor cables. For detailed instructions see the chapter on Installing the Cable Fittings.

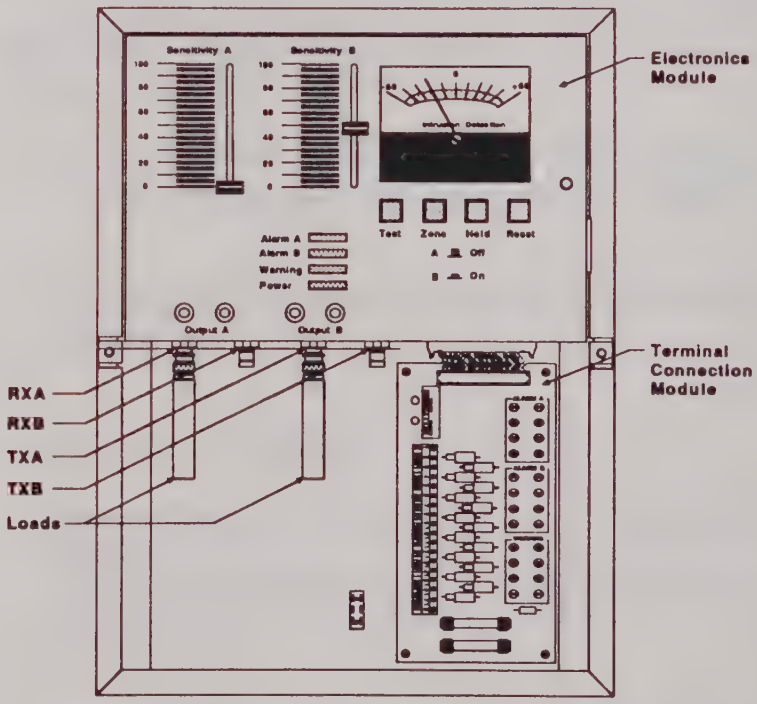
5. Measure the resistance between the headshell and center pin of each connector. It should be 130 kΩ ± 2 %, which is the value of the sensor cable supervision resistor in the terminator/decoupler.

6. Connect the sensor cables to the electronics module.

7. If this is a single-zone system, attach loads from the load set to the unused zone connectors on the electronics module.

   Set the sensitivity control for the unused zone to zero.

Loads Attached to Unused Zone A Connectors




The load set properly terminates the rf and cable-fault detection circuitry.

# Starting Up and Setting Sensitivity

# *Starting Up and Setting Sensitivity*


| | |
|---|---|
| Starting Up | 8-1 |
| Interpreting Panther's Output | 8-2 |
| Applying Power | 8-8 |
| Setting Up a Chart Recorder | 8-13 |
| Setting Sensitivity | 8-18 |
| Improving Sensitivity | 8-30 |
| Finishing Up | 8-40 |
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# Starting Up

This section outlines how to ensure that:

- all connections are correct
- sensitivity is properly adjusted

If the sensitivity is set too low, intruders may escape detection.

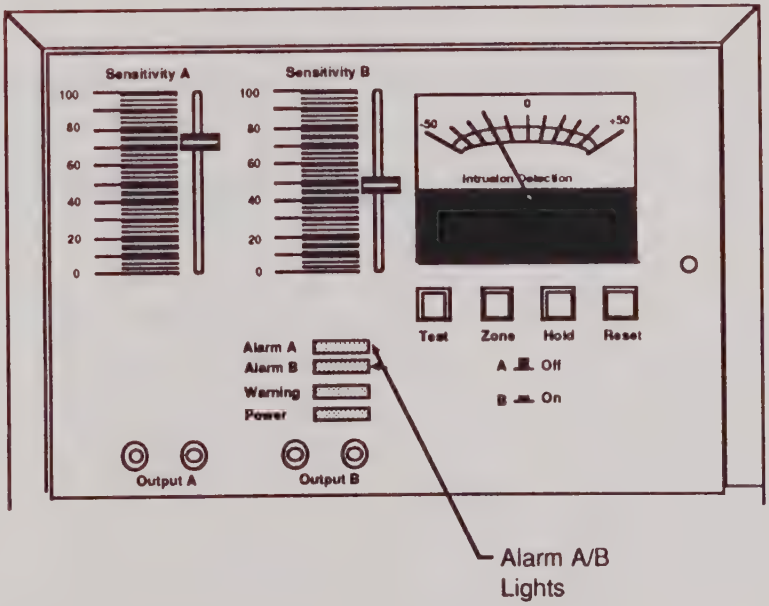
If the sensitivity is set too high, false alarms will be generated.

# Interpreting Panther's Output

## Lights and Relays

The alarm lights and alarm output relays are two-state devices - they are either on or off.

### Alarm Lights



When an intruder is detected, Panther illuminates an alarm light and deactivates the corresponding relay, indicating an alarm.

When no intruders are detected, the alarm lights are off and the alarm relays are activated.

If the Hold button is off, the alarm lights and alarm output relays for sensor alarms are not latched. This means that as soon as the triggering condition is removed, the lights go off and the relays are deactivated.

If the Hold button is on (pressed), the alarm lights and relays are latched. This means that the lights do not go off and the relays are not automatically deactivated as soon as the triggering condition is removed. You must press the Reset button, remotely reset the unit, or put the Hold button in the off position, in order to turn off the alarm lights and activate the relays.

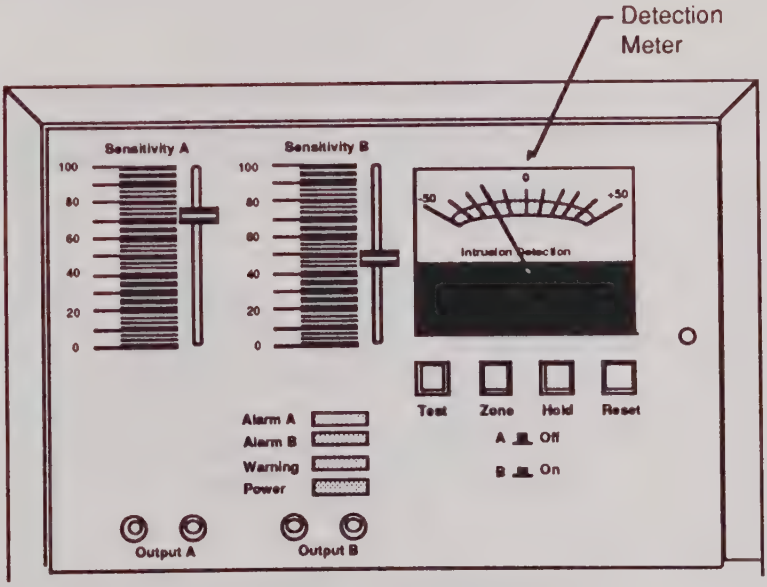
The alarm lights and relays for some warning alarms are latched. The lights do not go off and the relays are not automatically deactivated as soon as the triggering condition is removed. You must press the Reset button, or remotely reset the unit, to turn off the alarm lights and activate the relays.

Alarm latching ensures that you are alerted to any system problem, even if it's intermittent. It makes identifying and troubleshooting warning alarms easier.

## Detection Meter

The detection meter is an analog device. The readings it produces range from -50 (low) to +50 (high), with zero at the center of the scale.

Detection Meter



The deflection of the detection meter directly corresponds to the size of the disturbance in the detection field. For example, a bird generates a small deflection while an adult human generates a large deflection.

When no intruders are present, the meter indicates a low value. As an intruder approaches the detection field, the meter reading rises. A zero reading, at the center of the scale, corresponds to the alarm trip point. If the reading rises to zero or goes above it, Panther declares a sensor alarm. It illuminates the appropriate alarm light and deactivates the relay to signal the alarm condition.

## Analog Outputs

The analog outputs, Output A and Output B, produce a dc voltage which can range from -2.5 Vdc (low) to +2.5 Vdc (high). The voltage directly corresponds to the size of the disturbance in the detection field. In fact, the analog outputs and the detection meter readings correspond directly as shown in the table below.

Correspondence Between Analog Outputs and Detection Meter Readings

| Detection Meter Reading | | Voltage Level (Vdc) | |
|---|---|---|---|
| 50 | | 2.5 | |
| 40 | | 2.0 | |
| 30 | | 1.5 | Alarm |
| 20 | | 1.0 | |
| 10 | | 0.5 | |
| 0 | <- Alarm Trip Point -> | 0 | |
| -10 | | -0.5 | |
| -20 | | -1.0 | No |
| -30 | | -1.5 | Alarm |
| -40 | | -2.0 | |
| -50 | | -2.5 | |

The analog outputs allow you to connect a chart recorder to Panther's detection unit. The strip chart produced by the chart recorder provides you with a permanent record of sensitivity levels along the length of the perimeter.

**Converting Output Readings**

To convert a reading on the detection meter to an equivalent analog output voltage, divide the value on the meter by 20. Some examples:

+30 units ÷ 20 = +1.5 Vdc
-18 units ÷ 20 = -0.9 Vdc
0 units ÷ 20 = 0 Vdc

To convert an analog output voltage to the corresponding reading on the detection meter, multiply by 20. Some examples:

+1.5 Vdc x 20 = 30 units
-1.5 Vdc x 20 = -30 units
-2.0 Vdc x 20 = -40 units

For the alarm lights and relays:

- any negative voltage = no sensor alarm, lights and relays activated
- any positive voltage (including zero volts) = sensor alarm, appropriate light activated and relay deactivated

## Applying Power

**Power-Up Procedure**

Before you apply power, check the following:

- an adequate ground is installed using copper ground rod
- power connection polarity is correct
- sensor cables are attached
- load kit is attached, if necessary
- alarm panel is temporarily disconnected
- ribbon cable is attached firmly
- option selection switch is set correctly
- detection meter shows a reading of "0" (use screwdriver adjustment, if necessary)

1. Set DIP switch 6 to the closed position. Make sure that all other DIP switches are set to the open position.

2. Slide both sensitivity controls to the "0" position.

3. Set the Zone switch to the "A" position, and set the Hold switch to the "Off" position.

4. Leave both doors open and apply 12 Vdc of power. The Power light comes on and the Warning light flashes for 55 seconds while Panther powers up. During this time the outputs A and B are held at a constant level of either 1 Vdc or 0 Vdc, depending on how your analog output switches are set (DIP switches 2, 3 and 4). See page 7-35 for information on the switch settings.

   If the Power light doesn't come on, recheck your power supply and connections.

   If the Warning light doesn't flash during power-up, make sure that DIP switch 6 is closed.

5. When the power-up sequence is complete, the Warning light should turn off. If it doesn't, skip the remaining steps and go to the Identifying Warning Alarms section in the Troubleshooting and Repair chapter.

6. After the Warning light turns off, set DIP switch 6 to the open position. The Warning light turns on.

7. Close Panther's top and bottom doors. If you have an external enclosure with an external tamper switch, close that as well.

   If you leave DIP switch 6 in the closed position and close Panther's top door, the Warning light goes on. This is to prevent you from accidentally closing the door without reenabling the tamper - and allowing undetected entry into Panther.

8. The Warning light should turn off. If it doesn't, make sure that DIP switch 6 is set to the open position and check the connections to the external tamper switch, if you have one. Then push the Reset switch.

   If the Warning light is still on, skip the remaining steps and consult the Identifying Warning Alarms section in the Troubleshooting and Repair chapter.

**Functional Test**

Perform the following test to make sure all connections have been made properly. This test will also help you confirm that the detection electronics are working normally.

1. Power up as outlined in the above procedure.

2. Open Panther's top and bottom doors. The Warning light should turn on.

3. Set DIP switch 6 to the closed position. The Warning light should turn off. If it doesn't, refer to the chapter on Troubleshooting and Repair.

4. Press the Test switch. Ensure that alarms occur on both the A and B sides. If they don't, refer to the section on Solving Test Failures (Troubleshooting and Repair).

5. Set the Zone switch to the "A" position.

6. Slide the Sensitivity A control to "0".

   - The detection meter should show a reading in the green area.
   - The Alarm A light should be off.

7. Slide the Sensitivity A control to "100".

   - The needle of the detection meter should rise into the red area.*
   - The Alarm A light should be on.*

   * in some very low-noise sites, the needle may only rise into the yellow area.

8. Slide the Sensitivity A control to the point where the detection meter falls below -10, and leave the control there as an initial setting.

9. Set the Zone switch to the "B" position.

10. Repeat steps 6 to 8 using the Sensitivity B control.

If any of the above steps fails, try the following:

- Check your connections again and make sure nothing is loose, then repeat the test.
- Refer to the appropriate troubleshooting procedure (in the chapter on Troubleshooting and Repair), make any necessary adjustments, then repeat the test.
- Walk across each zone to see if the meter shows a response.

If the detection unit is still not operating properly, replace the detection electronics module and repeat the tests. See the section on Replacing the Electronics Module, in the next chapter.

# Setting Up a Chart Recorder

Panther's sensitivity is initially set using a strip chart recorder. The chart recorder is connected to the Output A and Output B jacks. The recorder provides a permanent record of Panther's sensitivity along the length of each zone. The chart recorder also makes it possible for one person to perform initial calibration and adjustment.

**Advantages of Dual Channels**

You can easily do a calibration by using a single-channel chart recorder, but a dual-channel chart recorder has some advantages:

- You can check for zone overlap in a two-zone decoupled system.
- You can observe the sensitivity of two zones simultaneously.
- You can save time.

**Necessary Features**

Whichever type of strip chart recorder you use, it must have the following features:

- rate adjustable from 25 to 50 mm/min (1 to 2 in/min)
- zero Vdc center scale
- range -2.5 Vdc to +2.5 Vdc

Examples:

- Astro-Med Dash II, dual-channel recorder
- Gould Model 220, dual-channel recorder
- Graphtec Model WR7500-2, dual-channel recorder
- Hioki Model 8201, compact single-channel recorder
- Linseis LM23-20-20, dual-channel recorder

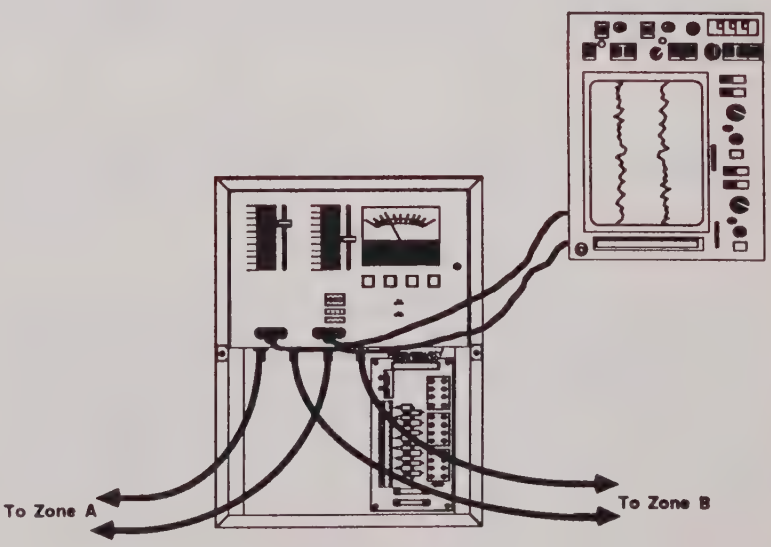
**Setup Procedure**

To set up the strip chart recorder :

1. Turn on the strip chart recorder and set the speed to 25 mm/min (1 in/min). Set the zero adjust (or offset) so that 0 Vdc is at center scale. Set the range to -2.5 Vdc to +2.5 Vdc.

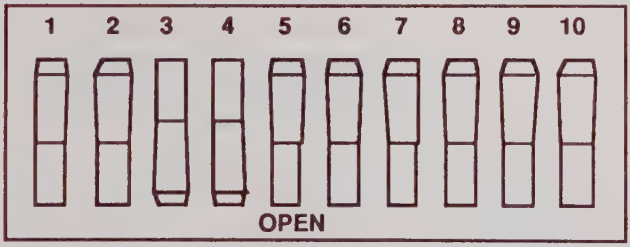
2. Use dual banana-plug patch cords to connect the strip chart recorder to the Output jack(s) of the zone(s) you want to adjust. Ensure that the ground terminals are connected to the black front panel jacks.

Connecting Strip Chart Recorder to Panther



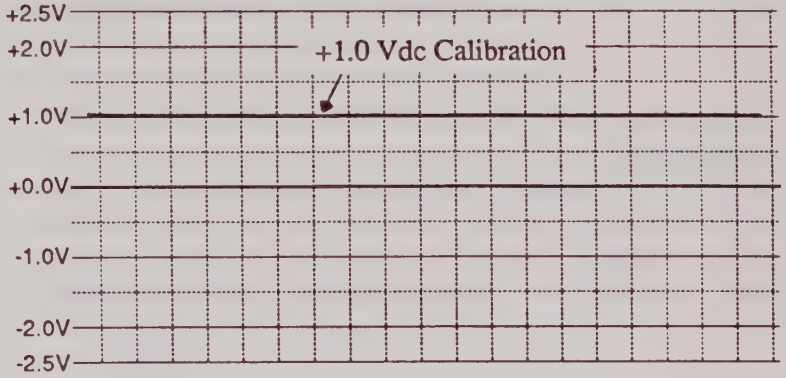
3. Panther can generate a +1.0 Vdc output that you can use to check your chart recorder. To obtain the +1.0 Vdc reference voltage, set option selection switch 3 and 4 to the closed position. The reference voltage appears on both the A and B outputs.

Setting DIP Switches for Reference Voltage



4. Adjust the strip chart recorder so that it registers +1.0 Vdc.

Strip Chart Shows +1.0 Vdc




5. Reset option selection switches 3 and 4 back to the open position.

6. Pull out the connector(s) from the Output jack(s). The chart recorder should show a reading of 0.0 Vdc. If it doesn't, readjust or replace the chart recorder. You can also generate a 0 Vdc output by setting the DIP switch at 2-closed, 3-open and 4-open.

## Setting Sensitivity

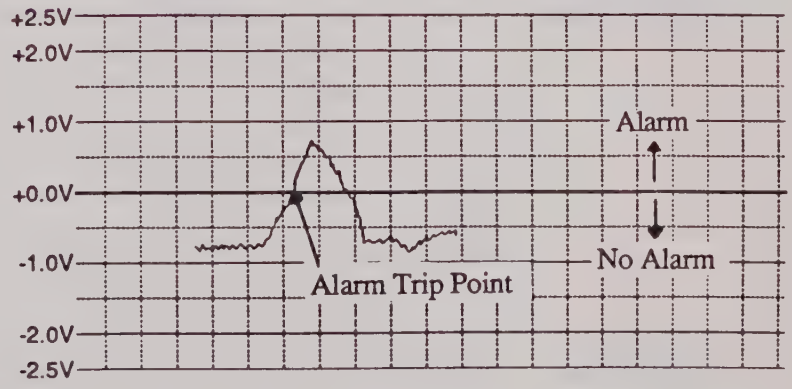
The voltage levels you observe on the chart recorder allow you to set Panther's sensitivity controls so that alarms are generated when a 70 kg (154 lb) adult human crosses the cables.

**Alarm Trip Point**

The alarm "trip point" is at 0.0 Vdc for each zone. When you're moving the sensitivity control, it is helpful to imagine that you're moving the strip chart trace up and down relative to the trip point. When you adjust a sensitivity control, you're actually adding a dc offset voltage to the analog output.

When no one is moving inside the detection field, Panther generates negative voltage levels, and the detection meter is in the green area. As an intruder approaches the detection field, Panther generates more positive (or higher) voltage levels. Panther deactivates an alarm relay and turns on the alarm light whenever it detects a positive voltage level (0.0 Vdc or higher). The detection meter moves to the red area.

Alarm at Positive Voltage Level

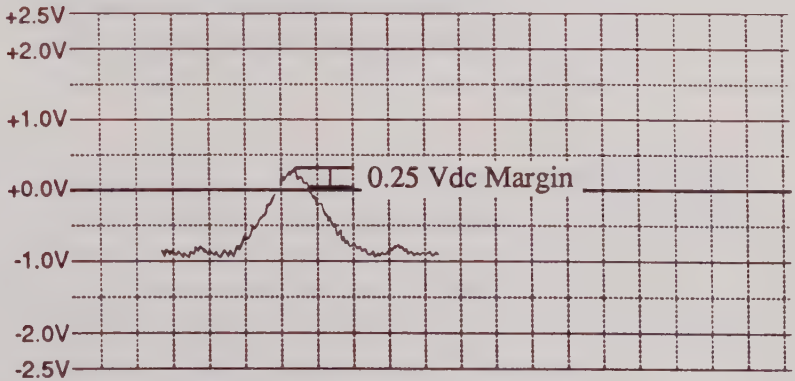


## Optimizing Detection

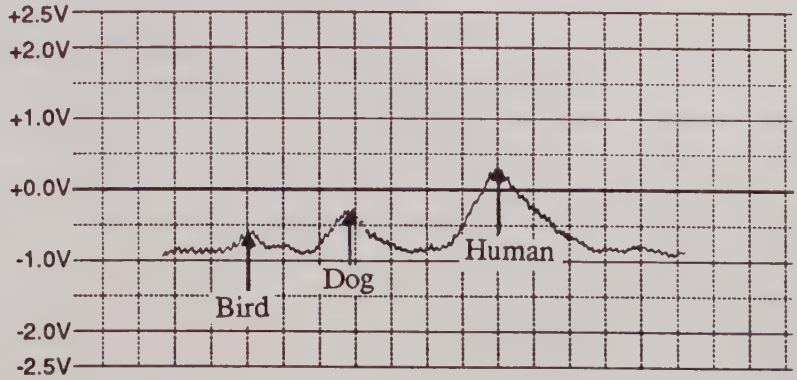
For optimum detection, set Panther's sensitivity controls so that a 70 kg (154 lb) adult human crossing the detection field generates an analog output of +0.25 Vdc.

This +0.25 Vdc margin above the "trip point" sets the sensitivity high enough to detect human intruders while eliminating false alarms caused by small animals and birds. The first chart recording below shows the +0.25 Vdc margin. The second chart recording shows how disturbances created by birds, dogs and humans compare when the sensitivity is set using this technique. Only a human intruder will cause an alarm.

Setting Margin to Detect Humans




Only Human Intruder Causes Alarm



**Key Points**

Remember:

1. Although voltage levels may vary within a zone, they must average between +0.25 Vdc and +0.5 Vdc for a human intruder, for the length of the zone.

2. The lowest acceptable voltage level produced by a human intruder is +0.10 Vdc. Levels lower than +0.10 Vdc increase the likelihood of failed alarms. See the Improving Sensitivity section of this chapter if you can't eliminate voltage levels lower than +0.10 Vdc.

3. The highest acceptable voltage level produced by a human intruder is +1.0 Vdc. Levels higher than +1.0 Vdc increase the likelihood of false alarms. See the Improving Sensitivity section of this chapter if you have large areas with levels higher than +0.5 Vdc.

**Sensitivity-Setting Procedure**

Adjust each zone independently as follows:

1. Connect the strip chart recorder to the Output jacks and set it up as described above. If there is only one zone connected to the detection unit, connect a load set to the Tx and Rx connectors of the unused zone. See the section on Making Final Connections (Installing the Detection Unit), for details.

2. Set the sensitivity control of the zone so that the chart recorder traces -0.5 Vdc or the detection meter shows a reading of -10 units.

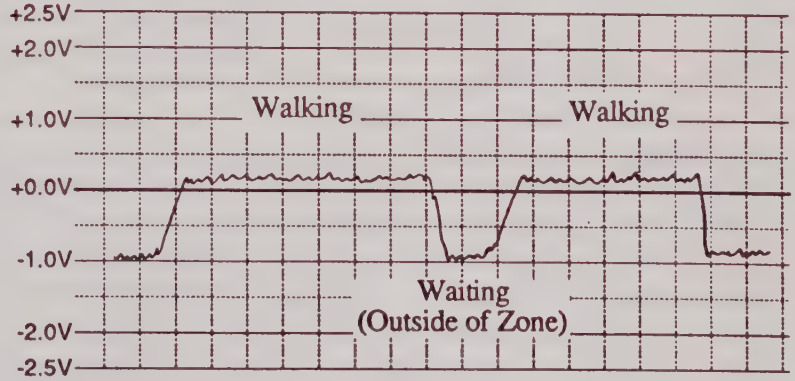
3. The sensitivity should be adjusted to detect a 70 kg (154 lb) human. If the person doing the walk test weighs significantly more, the sensitivity will be set too low. The description below assumes you are doing the walk test yourself.

4. Start the chart recorder, then start walking heel-to-toe at a point of 5 m (16 ft, 3 in) before the beginning of the zone to be tested and continue down the center of the sensor cable route. When you reach the end of the zone, walk 5 m (16 ft, 3 in) past the decouplers or terminators and stop. Wait for 20 seconds, turn around, and then walk slowly back down the center of the cable route in the opposite direction. Walk 5 m (16 ft, 3 in) past the start of the zone, stop, and wait 20 seconds.

5. Observe the strip chart recording of your walk test. The recording should show voltage levels between +0.25 Vdc and +0.5 Vdc for the period of time you were walking down the center of the cables. If the voltage levels average less than +0.25 Vdc, the sensitivity is too low. Slide the sensitivity control up. If the levels average more than +0.5 Vdc, the sensitivity is too high. Slide the control down.

   Perform another walk test to ensure that the new settings produce the proper voltage levels.

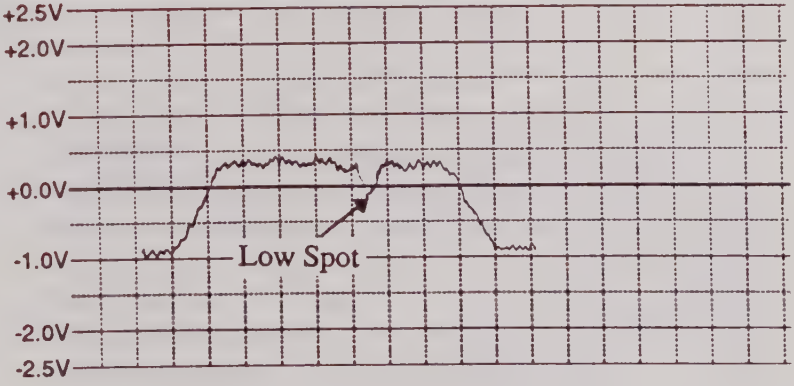
Walking Produces Voltage Between +0.25 and +0.5 Vdc



6. Once you've obtained voltage levels that average between +0.25 Vdc and +0.5 Vdc for your walk test, look at your chart recording to make sure the voltage doesn't drop below +0.1 Vdc. If there are places where the voltage is below 0.1 Vdc, the sensitivity level is still too low. Slide the Sensitivity control slightly higher and perform another walk test to ensure that the new setting produces the proper voltage levels.

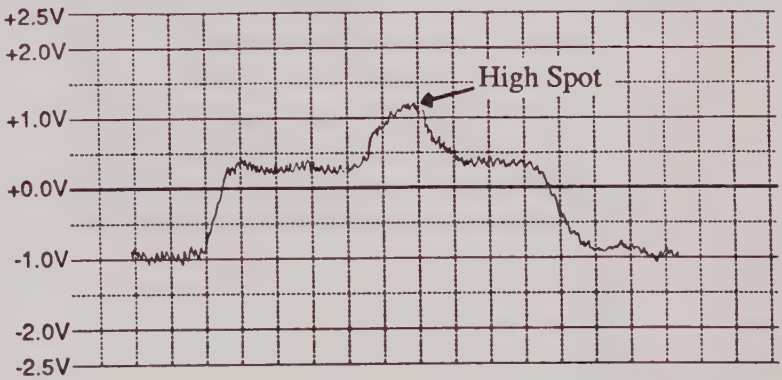
7. Very narrow spikes of low voltage can often be ignored. If there are points in the walk test where the voltage consistently drops well below +0.1 Vdc, mark the points where these low spots occur along the cable route and consult the Improving Sensitivity section in this chapter.

Voltage Under +0.1 Vdc



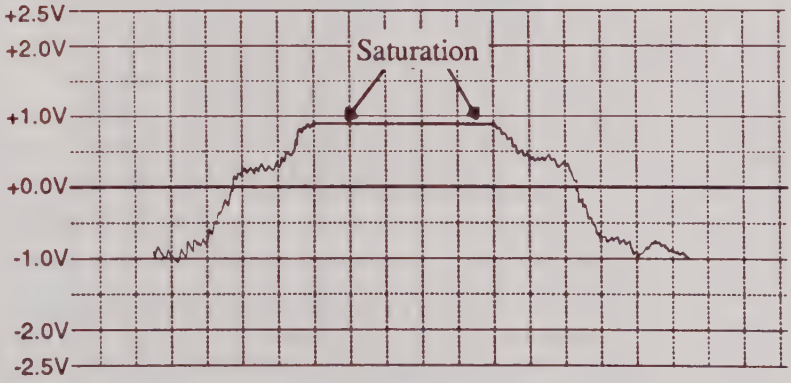
8. Look for spots on the chart recording where the voltage goes higher than +1.0 Vdc. The increased sensitivity in these areas of the zone may cause false alarms. Lower the sensitivity, if possible, by sliding the Sensitivity control down. Perform another walk test to ensure that the new setting produces the proper voltage levels. If there's little vehicular or pedestrian traffic near this area of the zone, it's unlikely there will be a problem. If there's a lot of traffic in the area of high sensitivity, consult the Improving Sensitivity section for more information.

Voltage Over +1.0 Vdc



9. Look for smooth, flat, high sections on the chart recording. These indicate that the zone is saturated. Saturation occurs when the zone is so sensitive that the radio-frequency signal overloads the receiver electronics. Adjust Panther according to the Saturation procedure in the Improving Sensitivity section.

Saturated Zone



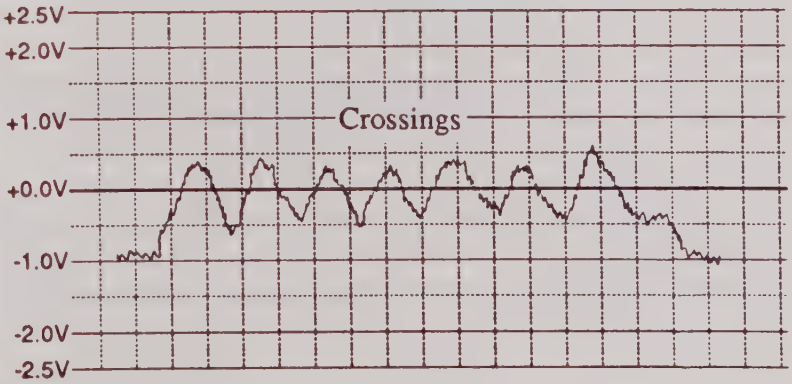
10. Press the Reset switch to lower the signal to its normal background state, and then walk the length of the zone, but outside the detection field. This test checks that the system doesn't detect you outside your intended protected zone. The strip chart should indicate less than 0.0 Vdc.

    If the voltage is higher than 0.0 Vdc, you must reduce the sensitivity of the zone. Slide the sensitivity control down and repeat the above tests. Then perform a walk test to ensure that you haven't set the sensitivity too low.

11. Repeat the last step, but on the other side of the cable route.

12. Walk the length of the zone outside the detection area. At 1 m (3 ft, 3 in) intervals, cross to the opposite side of the cable route. The strip chart should indicate approximately +0.25 Vdc to 0.5 Vdc for each crossing. Wait at least 20 seconds between crossings to allow Panther's electronics to reset following your previous intrusion.

Cable-Crossing Test




13. Look for points in the zone where you achieve exactly +0.5 Vdc when you cross the cables. Try to pick locations that have an easily identifiable landmark nearby. Mark these locations on your site plan so you can use them as test crossing points during system testing.

14. Repeat the test for the second zone, if there is one.

**Vehicle Protection**

In vehicle protection applications, the vehicles are parked directly over the sensor cables. The vehicles actually become enveloped by the detection field, providing superior protection against theft.

You must set the sensitivity level slightly lower for vehicle protection applications than you would for normal applications. The sensitivity must be reduced because the vehicles have a tendency to move slightly in the wind, which may produce false alarms. Remember that Panther is more sensitive to larger objects. The vehicles only have to move a small amount to produce an alarm. Your goal is to adjust the sensitivity so that small movements in the vehicles are ignored, but intruders are still detected.

Set the sensitivity level so that the strip chart records values between +0.1 Vdc and +0.25 Vdc when you do the walk test.

## Improving Sensitivity

When you calibrate Panther, you will find that analog output voltage varies at different points along the zone. This section tells you:

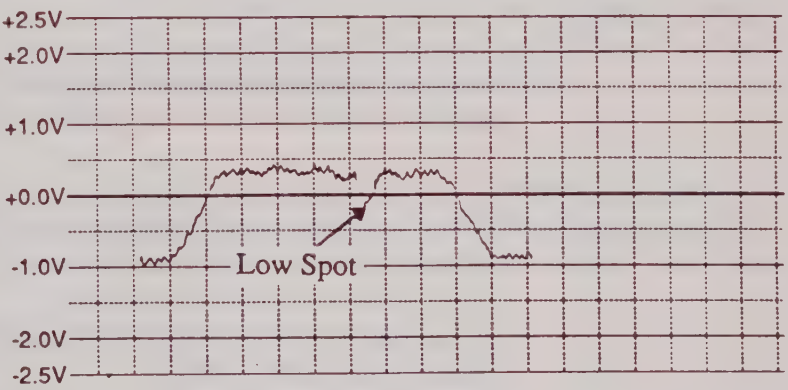
- how to determine if there really are problems
- what you can do to correct them

Two people, each carrying two-way radios, can quickly locate high and low spots along the cable route. You can look for high and low spots by yourself, but a great deal of time-consuming trial and error is required. The procedures given in this section are provided with the assumption that you have an assistant and two-way radios.

## Low Spots

Low spots in sensitivity may present problems if they are below 0.0 Vdc (0 units) when the rest of the zone is between +0.25 and +0.5 Vdc. An intruder may not be detected in areas of very low sensitivity. Raising the sensitivity of the whole zone so that the low spot is at +0.1 Vdc may make the rest of the zone too sensitive and cause false alarms.

Chart Indicates Area Under 0.0 Vdc




To test areas of low sensitivity, follow the procedure on the next page.

1. Have your assistant walk along the zone between the sensor cables while you observe the chart recorder. Tell your assistant to drop a marker (without stopping) when you notice the low spot being drawn on the chart recording. Have your assistant drop another marker where the low spot ends.

2. Keep the chart recorder running and walk across the cables several times at the point where the low spot occurs.

3. If each crossing generates an alarm (positive voltage levels greater than 0.0 Vdc), the zone needs no further adjustment.

4. If no alarm is generated in the low spot, you can do the following:

   - locate and remove any buried pipes or metal objects immediately beneath the cables
   - raise the cables a few inches closer to the surface 1 m (3 ft, 3 in) ahead of where the low spot occurs

Buried pipes and metal objects can reduce the sensitivity of the detection field if they're too close to the cables. They should be removed if they cause low spots. If you can't remove or locate these objects, you can compensate for the reduced sensitivity by bringing the sensor cables closer to ground level. The closer the sensor cables are to the surface, the more sensitive the detection field becomes.

You can choose to ignore a low spot if it doesn't occur in an area that's crucial to the security of the site. It's unlikely that an intruder will attempt to cross at exactly that spot.

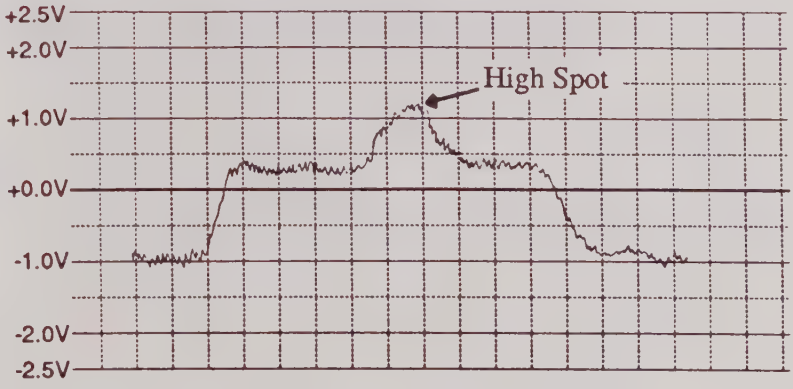
If the low spot is in a crucial area (e.g., in front of a gate), and the above procedures don't correct it, you may have to provide additional protection at that spot.

## High Spots

A high spot is categorized as any voltage level above +1.0 Vdc. High spots don't always adversely affect the operation of the system. Human intruders are still detected in these areas, but smaller targets such as small animals and birds might also be detected. Also, larger targets such as moving vehicles or humans could be detected if they're in the immediate vicinity of the high spot. A high spot may cause false alarms if it's within 4 m (13 ft) of:

- areas of high pedestrian traffic
- a frequently-used road
- a loose metal fence

Chart Indicates Area Above +1.0 Vdc



If there is an area of high pedestrian traffic near the high spot:

1. Keep your chart recorder running and walk along the pedestrian path near the high spot.

2. If no alarm is generated (a negative voltage level less than 0.0 Vdc), the traffic is not affecting system operation, and the high spot can be ignored. If an alarm is generated, bury the cables a few inches deeper at the high spot to reduce the sensitivity of the detection field.

If there is a road near the high spot:

1. Drive a large vehicle, preferably a truck or bus, down the road near the high spot.

2. If no alarm is generated, traffic on the road is not affecting system operation and the high spot can be ignored. If an alarm is generated (a positive voltage level higher than 0.0 Vdc), bury the cables a few inches deeper in the area near the high spot to reduce the sensitivity of the detection field.

If there is a loose metal fence near the high spot:

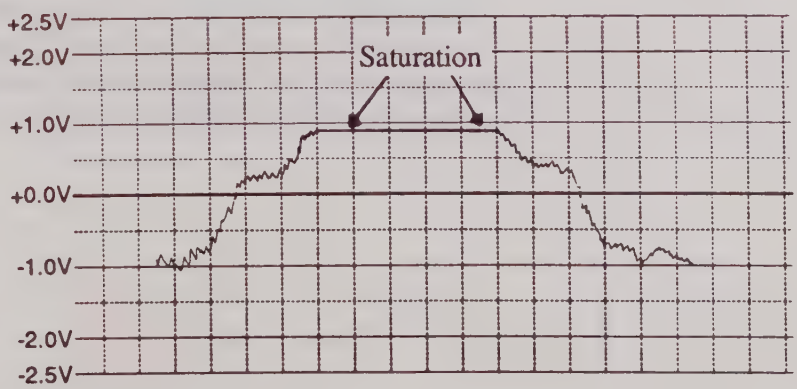
1. Shake the fence at a point near the high spot.

2. If no alarm is generated, the fence is not affecting system operation and the high spot can be ignored. If an alarm is generated (a positive voltage level higher than 0.0 Vdc), bury the cables a few inches deeper in the area near the high spot to reduce the sensitivity of the detection field.

## Saturation

If a chart recording of a zone produces a smooth, flat, high response during a walk test, the receiver electronics are being saturated. Saturation can occur in areas where the soil conditions make Panther too sensitive.

Chart Indicates Area of Saturation



Reduce Panther's sensitivity by following the procedure given below.

**Note**: This procedure reduces the sensitivity of **both** zones.

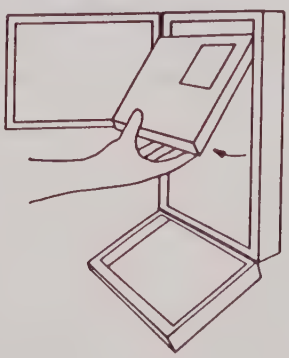
1. Disconnect the power. Disconnect the sensor cables and the ribbon cable from the electronics module.

2. Place your hand underneath the Tx and Rx connectors and grasp the bottom of the electronics module.

3. Unsnap the bottom of the electronics module from the housing by pulling firmly.

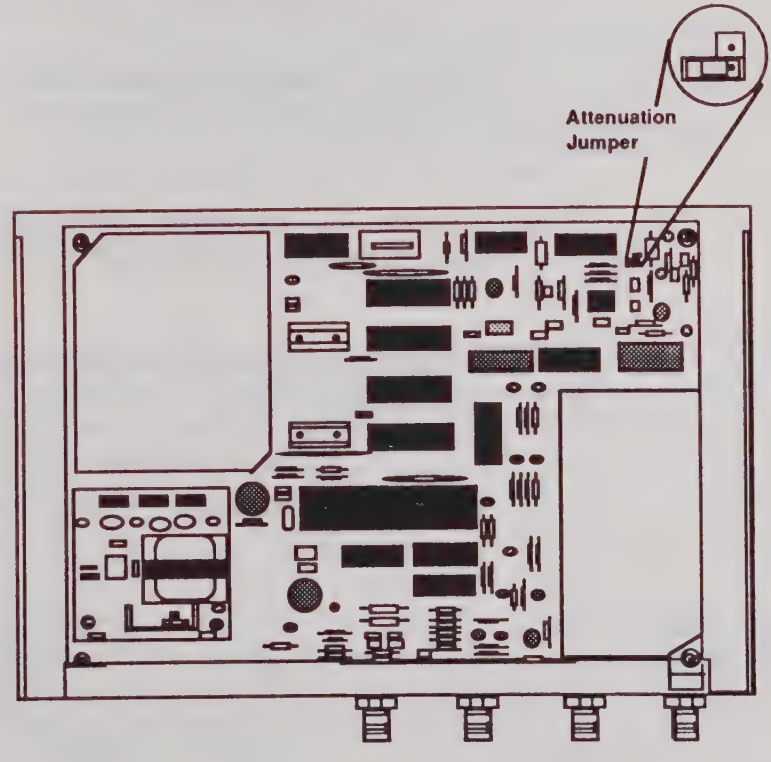
4. Swing the electronics module out and downward to remove it from the housing.

Removing Electronics Module from Housing



5. Locate the attenuation jumper on the back of the electronics module as shown in the illustration below.

Location of Attenuation Jumper



6. The jumper block is attached to one pin on the jumper. Pull the block off of the pin and push it back onto both pins.

7. Replace the electronics module in the housing and re-connect the sensor cables, the ribbon cable, and the power.

8. Re-calibrate both zones by following the steps in the Sensitivity-Setting Procedure (p. 8-22).

## Finishing Up

Before you demonstrate the system to the customer, you should follow the procedures given below.

**Documents**

1. Place a copy of the site plan in the inside front pocket of the Panther Owner's Guide. Make sure that the test crossing points for each zone are marked on the site plan.

2. Complete the information on the installation label and attach it to the inside front cover of the Owner's Guide.

Installation Label

**Information about your Panther system**

Serial number: _____

Installation date: _____

Installer's name: _____

Calibration date: _____

Number of zones: _____

**Sensitivity Control Settings**

| | Zone A | Zone B |
|---|---|---|
| Summer | | |
| Winter (frozen ground) | | |

**Detection Meter Readings**

| | Zone A | Zone B |
|---|---|---|
| Normal (green) | | |
| Alarm (red) | | |

**Your Dealer**

Name: _____

Address: _____

Phone: _____

Emergency phone: _____

**Your Central Alarm Monitoring Service**

Name: _____

Address: _____

Phone: _____

Emergency phone: _____

Account number: _____

3. Clip the Owner's Guide inside the detection unit top door.

4. Perform the system test described in the next section.

# Performing a System Test

**Walking the Cable Route**

Walk the cable route with the customer and carry a copy of the site plan with you. Point out:

- poor fencing that should be repaired or removed to reduce the possibility of false alarms
- materials stored too close to the cable route which could cause false alarms
- how the cable route is marked on the site plan
- test crossing points marked on the site plan

**Preliminary Test**

Perform a preliminary test by using the Test switch on the electronics module. Pushing the test switch causes the alarm indicators and relays to activate for 3 seconds.

## Crossing Test

It's possible for one person to do the crossing test by using the detection meter and Hold button located on the detection unit. This button makes the detection meter hold the maximum value registered during a test. This method does not give any indication of the range of readings encountered, so it must not be used for anything other than quick confirmations of proper operation.

The procedure given below is the same as the procedure given in the "How do I Test the System" section of the Owner's Guide. Have the customer follow through the procedure with you. Point out that this procedure may be necessary to compensate for sensitivity changes whenever the ground freezes or thaws.

If you're testing a site designed for vehicle protection applications, perform this test with the vehicles parked on top of the cables. Explain to the customer that Panther indicates slightly lower detection meter readings during test crossings when vehicles are present. However, if you've set the sensitivity correctly you should always obtain a reading in the red whenever you cross the cables.

1. Using the instructions given in the chapter on How Panther Works (The Detection Unit) and the "What Do the Controls Do?" section of the Panther Owner's Guide, open the top door to access the controls. The yellow Warning light should glow.

2. You must test each zone separately. Use the Zone switch to select the zone to be monitored by the detection meter.

3. Set the Hold switch to the "On" position.

4. Press the Reset button to clear the detection meter reading.

5. Walk across the sensor cables at the test crossing point in the zone you are testing (see your site plan). Walk at a normal pace.

6. The detection meter should indicate a reading from +5 to +10. If it does, skip the next step and go on to step 8. If you are testing a vehicle protection installation, any indication above 0 is acceptable.

7. If the reading is below +5 (below 0 for vehicle protection installations) or above +10, slide the sensitivity control for the zone you are testing until the detection meter indicates the desired reading. Return to step 4.

8. If there is a second zone, use the Zone switch to set the detection meter to monitor that zone. Repeat steps 4 to 7.

When testing and adjustment is complete:

1. Set the Hold switch to the "Off" position.

2. Make sure there is no one in the detection field and observe the detection meter readings for each zone. The readings should be in the green (below -10 Vdc).

3. If the detection meter readings are in the yellow or red in either zone, the sensitivity is too high in the zone giving those readings. Re-adjust the sensitivity as described above.

**Demonstrating the Unit**

Demonstrate the following for the customer:

- how to unlock and open the top door of the detection unit
- all of the lights and controls on the detection unit
- how to solve alarms (refer to the chapter on Troubleshooting and Repair)
- the location of the Panther Owner's guide, installation label, and site plan (inside the top door)
- the sensitivity adjustment procedure in the Owner's Guide

**Customer Sign-off**

Have the customer sign the approval portion of the work order once the demonstration is complete, and hand over both detection unit keys.

# Troubleshooting and Repair

# Troubleshooting and Repair


| | |
|---|---|
| Fault-Finding Table | 9-1 |
| Solving Power Failures | 9-2 |
| Identifying Warning Alarms | 9-6 |
| Solving Tamper Alarms | 9-10 |
| Repairing Cables | 9-14 |
| Replacing the Electronics Module | 9-38 |
| Replacing the Terminal Connection Module | 9-41 |
| Solving Input Supervision Faults | 9-43 |
| Solving Test Failures | 9-45 |
| Solving Alarm Failures | 9-46 |
| Solving False Alarms | 9-47 |

# Fault-Finding Table

This chapter explains how to find and solve problems that might occur with Panther. The table below lists the main problems that you might have, and points you to the appropriate section in the chapter.

Fault-Finding Table

| What's Wrong | Where to Look | Page |
|---|---|---|
| Power light is off | Solving Power Failures | 9-2 |
| Warning light is on | Identifying Warning Alarms | 9-6 |
| No alarms during self-test | Solving Test Failures | 9-45 |
| No alarms during intrusion | Solving Alarm Failures | 9-46 |
| Alarms when there's no intruder | Solving False Alarms | 9-47 |

# Solving Power Failures

**Power-up Failure**

If the Power light doesn't come on when you try to power-up Panther, follow the steps below. Reapply power after each step.

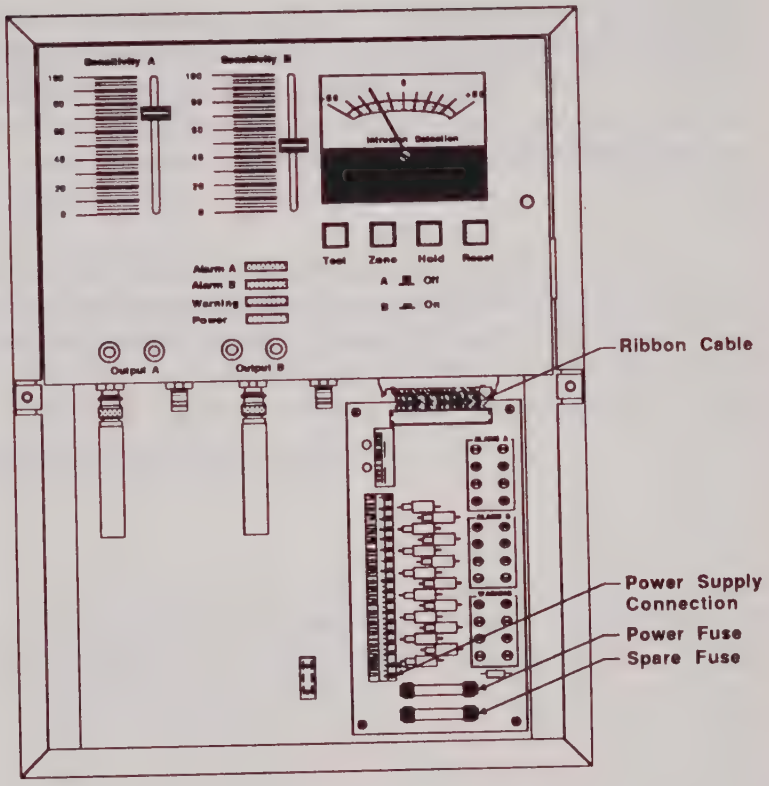
1. Make sure that Panther is properly connected to the power supply:

   a. Check that the power supply is connected to Panther at terminals 17 and 18 of the terminal connection module.

   b. Ensure that the terminal connection module's ribbon cable is properly fastened to the electronics module.

   c. Check the fuse on the terminal connection module. If the fuse is blown, snap the fuse out and replace it with the spare fuse. Remember to replace a new fuse in the spare socket (3/4 A fast blow 3AG type: Littlefuse P/N 312.750, Buss P/N AGC 3/4 A, or equivalent).

Checking Power Supply Connections




2. If step 1 doesn't work, check the voltage coming from the power supply. It must be between 10.2 and 13.8 Vdc. Adjust it if necessary.

3. Check the option selection switch (DIP switch) to ensure that switches 1, 2, 3 and 4 are open.

4. If there is still no power, try removing and re-inserting Panther's electronics module. Follow the instructions in the section on Replacing the Electronics Module, in this chapter. If the original electronics module doesn't work, try replacing it with a new electronics module.

5. If step 4 doesn't work, replace Panther's terminal connection module. Follow the instructions in the section on Replacing the Terminal Connection Module, in this chapter.

6. If the power still doesn't come on, call your dealer.

**Input Power Fail**

If the Power light goes off and the Warning light comes on while Panther is active, it means that the voltage has dropped below the range of 10.2 to 13.8 Vdc. Adjust the level to between 10.2 and 13.8 Vdc. The Warning light should go off and the Power light should come back on. If the power light doesn't come back on, follow the steps in the previous section.

If all lights go off, it means that the voltage has dropped far outside the range of 10.2 to 13.8 Vdc. Adjust the level to between 10.2 and 13.8 Vdc. The Power light should come back on. If it doesn't, recycle the power (i.e., turn off, then on) and follow the steps in the previous section.

**Erratic Power**

If power is erratic, the Power and Warning lights might flicker. To avoid this, adjust or replace your power supply so that its range falls within 10.2 to 13.8 Vdc.

# Identifying Warning Alarms

## Alarm Types

Warning alarms can be triggered by one or more of the following conditions:

- local tamper - someone opens Panther's top door
- external tamper - someone opens the box housing the Panther enclosure and activates the external tamper switch (external tamper input is grounded)
- Tx cable fault - transmit cable fault
- Rx cable fault - receive cable fault
- sensor failure - failure of the detection unit electronics
- input supervision fault - supervised input line cut
- input power failure - power supply voltage drops below range of 10.2 to 13.8 Vdc

If any of the above conditions occurs, the Warning light comes on. In order to determine which condition has triggered the alarm, you must access Panther's diagnostic feature.

**Note**: In the case of input power failure, the Power light will go off. Therefore, you can determine this condition without performing Panther's diagnostics. See the previous section on Solving Power Failures for information on solving this alarm.

## Panther's Diagnostics

Panther provides built-in diagnostics, so there's no need for extra diagnostics equipment.

In Panther's diagnostics feature, the four indicator lights and the Zone switch are used to specify various alarm conditions. Each light corresponds to a particular alarm type. A total of eight alarm conditions can be indicated - four with the Zone switch in position A, and four with the Zone switch in position B.

## Performing Diagnostics

If Panther's yellow Warning light comes on, perform the following steps:

1. Open Panther's top and bottom doors.

2. Close DIP switch 6 to disable the tamper alarm. This eliminates the alarm generated by opening Panther's doors. The Warning light stays on.

3. Close DIP switch 1 to access Panther's diagnostics feature. Some lights may change state and the needle on the detection meter swings back and forth from -50 to 0.

4. Set the Zone switch to position A.

5. Note any indicator lights that come on. Use the table below to find out the meaning of the lights and where to find the instructions for solving the alarms.

6. Set the Zone switch to position B.

7. Note any indicator lights that come on. Use the table below to find out the meaning of the lights and where to find the instructions for solving the alarms.

Indicator Lights and their Meanings

| Zone Switch | Light | Alarm Type | Refer To | Page |
|---|---|---|---|---|
| A | Alarm A | Local Tamper | Solving Tamper Alarms | 9-10 |
| A | Alarm B | External Tamper | Solving Tamper Alarms | 9-10 |
| A | Warning | Tx Cable Fault | Repairing Cables | 9-14 |
| A | Power | Rx Cable Fault | Repairing Cables | 9-14 |
| B | Alarm A | Sensor Failure | Replacing the Electronics Module | 9-38 |
| B | Alarm B | Reserved | | |
| B | Warning | Reserved | | |
| B | Power | Input Supervision Fault | Solving Input Supervision Faults | 9-43 |

8. After each attempt to solve an alarm, press Reset and see if the corresponding indicator light turns off. If it does, you have solved the alarm.

9. Repeat step 8 until all of the indicator lights are off when the Zone switch is in either position A or B.

10. If you can't eliminate one or more of the alarms by following the instructions in the applicable section, call your dealer.

**Exiting Diagnostics**

1. Open DIP switch 1 to exit Panther's diagnostics feature. The needle on the detection meter stops swinging.

2. Open DIP switch 6 to re-enable the tamper alarms. The Warning light turns on.

3. Close and latch Panther's top and bottom doors. The Warning light should turn off. If it doesn't, go back to step 1 of Performing Diagnostics.

# Solving Tamper Alarms

**What They Are**

There are two types of tamper alarms:

- local tamper - someone opens Panther's top door
- external tamper - someone opens the box housing the Panther enclosure and activates the external tamper switch (external tamper input is grounded)

In Panther's diagnostics:

- a local tamper is signalled by the Alarm A light when the Zone switch is in position A
- an external tamper is signalled by the Alarm B light when the Zone switch is in position A

**Disabling Tamper Alarms**

To disable both kinds of tamper alarms:

1. Close DIP switch 6. This permits the top door to be opened without generating a warning alarm. If you close the door now, a warning alarm should occur (see the note on Added Safety, p. 9-13). The Alarm A and B lights will go off when the top door is open, in diagnostics mode.

2. If the lights don't go off, adjust the tamper switch as shown below:

**Adjusting the Tamper Switch**

1. Set option selection switch 6 to the open position to enable the door tamper alarm.

2. Close and lock the detection unit doors. The Warning light should be off. If the light remains on, adjust the tamper switch plunger by using step 5 of this procedure.

3. Attempt to open the locked door. Do not use excessive force. It should stay shut and the tamper warning alarm should not trigger.

4. Unlock the door and begin to open it. The tamper warning alarm should trigger immediately.

5. If a warning alarm is generated too soon, the tamper switch plunger located on the door is too short. Lengthen the plunger by turning it counter-clockwise with a screwdriver.

6. Reset and re-adjust the plunger until operation is satisfactory.

If there are more alarms to clear, follow the instructions in the appropriate sections of this chapter.

## Exiting Diagnostics

If there are no more alarms, perform the following:

1. Open DIP switch 1 to exit Panther's diagnostics feature. The needle on the detection meter stops swinging.

2. Open DIP switch 6 to re-enable the tamper alarms. The Warning light turns on.

3. Close and latch Panther's top and bottom doors. The Warning light should turn off. If it doesn't, go back to step 1 of Performing Diagnostics.

**Added Safety**

If you leave DIP switch 6 in the closed position and close Panther's top door, the Warning light goes on. This is to prevent you from accidentally closing the door without re-enabling the tamper, and allowing undetected entry into Panther.

This feature ensures that when Panther's door is closed, you know that your perimeter is protected.

If you are in diagnostics, closing the door automatically returns you to normal mode.

## Repairing Cables

Cables that have been cut or scraped need to be repaired, otherwise, the detection signals might be distorted.

In Panther's diagnostics:

- a transmit cable fault is signalled by the Warning light when the Zone switch is in position A
- a receive cable fault is signalled by the Power light when the Zone switch is in position A

**Note**: a cable fault will also occur if you have not attached a load set to unused zone connectors. Refer to the procedures in the section on Making Final Connections (Installing the Detection Unit).

## Assessing Cable Damage

Cable damage is categorized as:

- Superficial - a very small cut or scrape on the jacket
- Minor - a cut less than 1 cm (3/8 in) in length
- Moderate - a damaged section less than 2.5 cm (1 in) in length
- Severe - a damaged section more than 2.5 cm (1 in) but less than 3 m (9 ft, 9 in) in length
- Irreparable - a damaged section more than 3 m (9 ft, 9 in) in length

What appears to be only superficial damage may be quite extensive. If the cut or abrasion has gone through the outer jacket, carefully examine the cut. Even superficial cuts or scrapes should be taken care of because water can slowly enter a small cut and cause major internal damage.

- If corrosion is visible, cut back the jacket until you reach an uncorroded section. Classify the damage based on the length of jacket you have stripped.
- If the dielectric is damaged, the damage is moderate.
- If four or more strands of the copper braid are broken, the damage is minor.
- If three strands or less of the braid are broken, the damage is superficial.

## Using Splices

Splices are used:

- to provide non-detecting sections in the middle of a detecting zone
- to repair a damaged cable

DO NOT use splices to lengthen a cable! Cable length must fall within the following limits:

- the detecting section: 10 to 150 m (33 to 492 ft)
- the lead-in section: 10 to 50 m (33 to 164 ft)

Never splice a piece of detecting cable into non-detecting cable.

Non-detecting cable must not be spliced into detecting cable except to provide a non-detecting section (called a bypass) within a detecting area. See the chapter on Installing the Cables for more information about installing bypass areas.

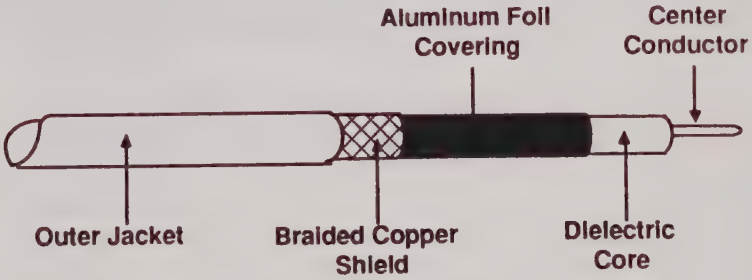
## Determining Cable Type

Before you make repairs or splices, determine the type of cable you're working on, by examining the site plan.

Non-detecting cable has:

- a foil layer
- a solid layer of copper braid

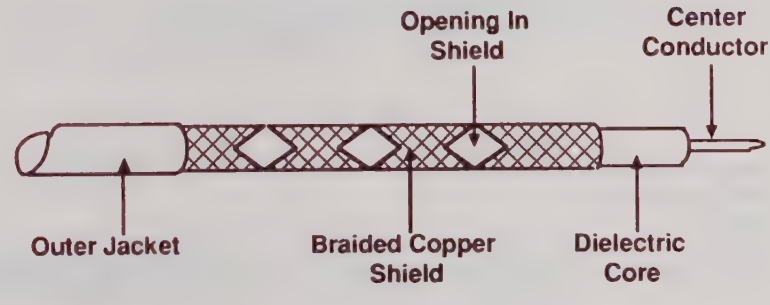
Construction of Non-Detecting Cable



Detecting cable has:

- no foil layer
- diamond-shaped holes in the copper braid

Construction of Detecting Cable



**Tools and Materials**

You should have the following tools and materials available whenever you repair cables:

- Panther cable splice kit which includes:
  - two male TNC connectors
  - two female TNC connectors
  - one cable preparation kit
  - one roll of putty tape
  - two pieces of shrink tubing
  - three meters of detecting cable
- standard tools for installing connectors (see the chapter on Installing the Cable Fittings)
- electrical tape
- female to female TNC adapter
- TNC/Banana plug adapter cable
- ohmmeter
- knife or scissors

**Repairing Superficial Damage**

1. Rub the cable jacket with sandpaper from the cable preparation kit and wipe the cable with the supplied cleaning cloth. This roughens and cleans the cable surface for a good bond to the putty tape.

2. Wrap overlapping layers of putty tape around the damaged section.

3. Wrap electrical tape over the putty tape for extra mechanical protection.

4. Mark the location of the damage on the site plan.

**Repairing Minor Damage (Less than 1 cm [(3/8 in])**

1. Cut the cable at a point near the center of the damaged area. Strip each end with the Panther stripping tool.

2. If corrosion is present, assess the damage (it may be moderate or severe). If corrosion is not present, proceed with the next step.

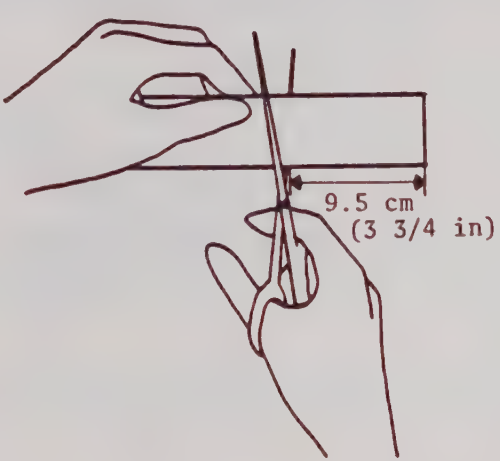
3. Install a male connector on one cut cable end and install a female connector on the other cable end. Use the procedures given in the chapter on Installing the Cable Fittings.

4. Rub 10 cm (4 in) of each cable with the sandpaper from the cable preparation kit and wipe the cables with the supplied cleaning cloth. This roughens and cleans the cable surface for a good bond to the putty tape.

Wiping Cable

5. Cut two 9.5 cm (3 3/4 in) strips of putty tape.

Cutting Putty Tape




6. Place the putty tape lengthwise along each cable flush against the connector headshells. The distance from the back of each headshell to the ends of each tape should be 9.5 cm (3 3/4 in).

7. Mold the tape around each cable.

Molding Tape Around Cable

8. Slide the shrink tubing onto one cable so that the long plastic strip inside the tubing trails out toward the connector.

9. Connect the female connector to the male connector.

Connecting Female and Male Connectors

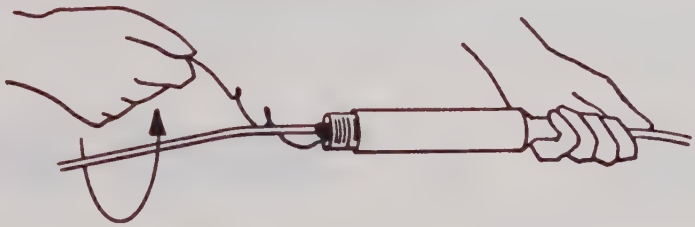
**CAUTION: Putty tape must not protrude above the back of the connector.**

10. Hold the shrink tubing over the connectors so that 0.5 - 1 cm (1/4 - 1/2 in) of putty tape is exposed on one cable.

11. Collapse the shrink tubing around the connectors by pulling and unwinding the plastic tape wound inside the tubing, in a counter-clockwise direction. **Unwind the plastic tape out using a spiral motion to avoid wrapping it around the cable or the putty tape.** Failure to follow this procedure could result in the plastic tape becoming entangled in the putty tape. If this happens, remove the tubing, and follow the procedures from step 10 with a new piece of tubing.

    Make sure you begin collapsing the tubing 0.5 - 1 cm (1/4 - 1/2 in) from the end of one of the pieces of tape. The shrink tubing will stretch as it collapses and should center over the connectors and tape.

Collapsing Shrink Tubing



12. Mark the location of the damage on the site plan.

**Repairing Moderate Damage (Less than 1.5 cm [1 in])**

1. Cut out the damaged section of the cable (cut out a piece the same length as the female to female adapter). Strip each end using the Panther stripping tool.

2. If corrosion is present, assess the damage (it may be severe). If corrosion is not present, proceed with the next step.

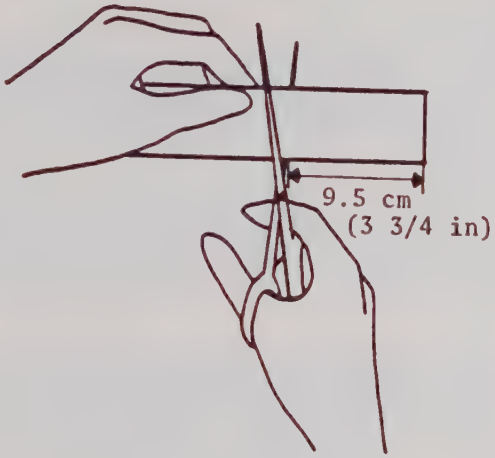
3. Install male connectors on both cables. Use the procedures given in the chapter on Installing the Cable Fittings.

4. Rub 10 cm (4 in) of each cable with the sandpaper from the cable preparation kit and wipe the cables with the supplied cleaning cloth. This roughens and cleans the cable surface for a good bond to the putty tape.

Wiping Cable

5. Cut two 9.5 cm (3 3/4 in) strips of putty tape.

Cutting Putty Tape




6. Place the putty tape lengthwise along each cable flush against the connector headshells. The distance from the back of each headshell to the ends of each putty tape should be 9.5 cm (3 3/4 in).

7. Mold the tape around each cable.

Molding Tape Around Cable

8. Slide the shrink tubing onto one cable so that the long plastic strip inside the tubing trails out toward the connector.

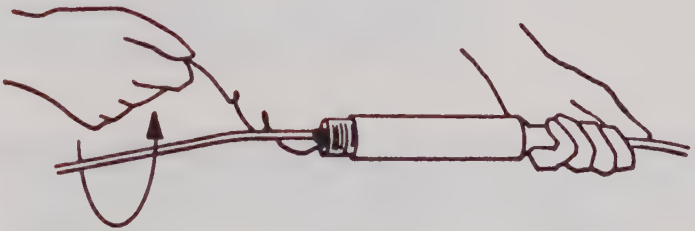
9. Connect the two male connectors together with the female to female adapter.

10. Hold the shrink tubing over the connectors so that 0.5 - 1 cm (1/4 - 1/2 in) of tape is exposed on one cable.

11. Collapse the shrink tubing around the connectors by pulling and unwinding the plastic tape wound inside the tubing, in a counter-clockwise direction. **Unwind the plastic tape out using a spiral motion to avoid wrapping it around the cable or the putty tape.** Failure to follow this procedure could result in the plastic tape becoming entangled in the putty tape. If this happens, remove the tubing, and follow the procedures from step 10 with a new piece of tubing.

    Make sure you begin collapsing the tubing 0.5 - 1 cm (1/4 - 1/2 in) from the end of one of the pieces of tape. The shrink tubing will stretch as it collapses and should center over the connectors and tape.

Collapsing Shrink Tubing



12. Mark the location of the damage on the site plan.

**Repairing Severe Damage (Less than 3 m [9 ft, 9 in])**

1. Cut out the damaged section of the cable (cut out a piece shorter than 3 m). Strip the ends with the Panther stripping tool.

2. If corrosion is present, assess the damage (it may be irreparable). If corrosion is not present, proceed with the next step.

3. Install a male connector on one cut cable end and another male connector on the other cable end. Use the procedures given in the chapter on Installing the Cable Fittings.

4. Cut the spare cable to length.

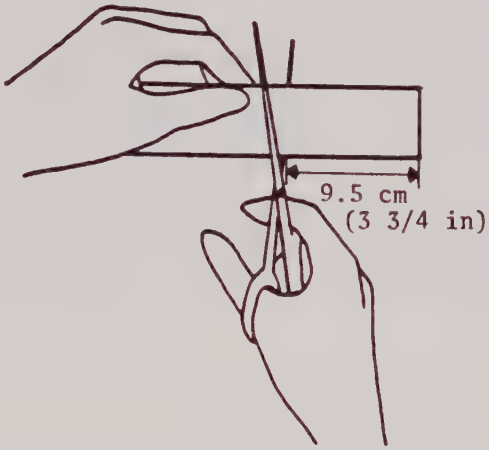
5. Install female connectors on both ends of the spare cable.

6. Rub 10 cm (4 in) of each cable with the sandpaper from the cable preparation kit and wipe the cables with the supplied cleaning cloth. This roughens and cleans the cable surface for a good bond to the putty tape.

Wiping Cable

7. Cut four 9.5 cm (3 3/4 in) strips of putty tape.

Cutting Putty Tape




8. Place the putty tape lengthwise along each cable flush against the connector headshells. The distance from the back of each headshell to the ends of each putty tape should be 9.5 cm (3 3/4 in).

8. Mold the tape around each cable.

Molding Tape around Cable

10. Slide two pieces of shrink tubing onto each end of the cut cable so that the long plastic strip inside the tubing trails out toward the connector.

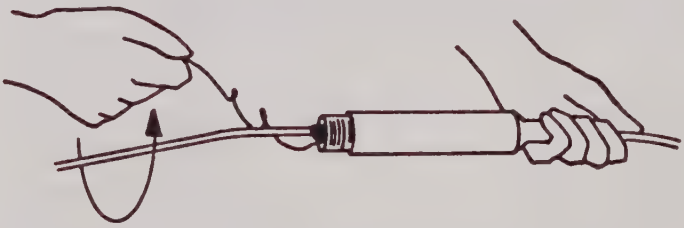
11. Splice the spare cable into the cut cable by connecting the two male connectors to the female connectors on the spare cable.

12. Hold the shrink tubing over the connectors so that 0.5 - 1 cm (1/4 - 1/2 in) of putty tape is exposed on one cable.

13. Collapse the shrink tubing around the connectors by pulling and unwinding the plastic tape wound inside the tubing, in a counter-clockwise direction. **Unwind the plastic tape out using a spiral motion to avoid wrapping it around the cable or the putty tape.** Failure to follow this procedure could result in the plastic tape becoming entangled in the putty tape. If this happens, remove the tubing, and follow the procedures from step 12 with a new piece of tubing.

    Make sure you begin collapsing the tubing 0.5 - 1 cm (1/4 - 1/2 in) from the end of one of the pieces of tape. The shrink tubing will stretch as it collapses and should center over the connectors and tape.

Collapsing Shrink Tubing



14. Mark the location of the damage on the site plan.

**Irreparable Damage (More than 3 m [9 ft, 9 in])**

DO NOT attempt to splice in new cable where more than 3 m (9 ft, 9 in) of the detecting section has been damaged. Replace the entire cable or use the procedure given below.

**Alternative to Cable Replacement**

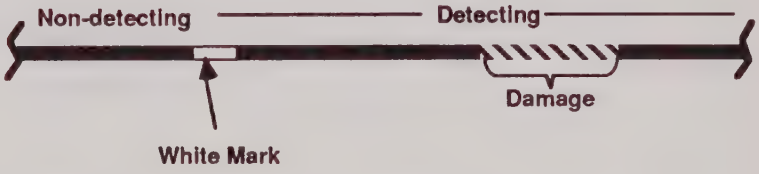
If the cable has been buried in concrete, for example, it may be impractical to replace the entire cable. In this case it's permissible to splice in a new section of cable to replace the damaged section, provided that the procedures described below are used.

Be very careful when replacing a damaged section that includes detecting cable. The interior "ports" or holes inside the detecting cable get bigger along its length. You must make sure that the new section of cable has holes in the braid that are the same size as the holes in the damaged section.

You can replace a long section of damaged cable by doing the following:

1. Measure (or estimate) the length from the "white mark" to the end of the damaged section.

Measuring Distance from White Mark to End of Damage




2. Obtain a new sensor cable that is the same original length as the damaged cable, i.e.:

   100 m ⇒ 100 m
   150 m ⇒ 150 m

3. Unroll the new cable along the path of the damaged cable.

4. Make sure both cables have the non-detecting section at the same end.

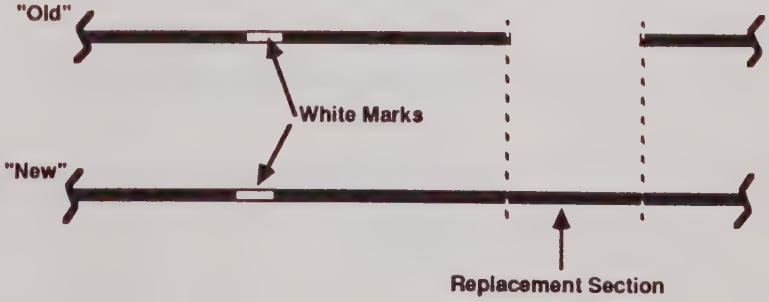
5. Align the "white marks" on the old and new cables.

Aligning White Marks on Cables

6. Cut out and discard all of the damaged cable section.

7. Cut a section out of the new cable which is at the same location as the section removed from the damaged cable.

Cutting Replacement Section from New Cable

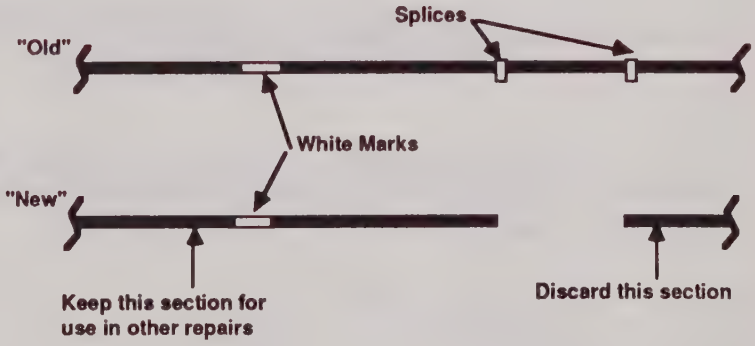


8. Splice the new cable section into the damaged cable.

9. Keep the end of the new cable that includes the non-detecting section of the new cable. It can be used in future repairs or in locations where you need a short cable.

10. Discard the unused detecting portion of the new cable. DO NOT use it for future repairs. The holes in the braid will be the wrong size.

Discarding Unused Detecting Portion of New Cable




11. Mark the location of the replaced section on the site plan.

# Replacing the Electronics Module

**Why Replace the Electronics Module**

If you are unable to power-up Panther by following the steps in the power-up procedure, this might indicate that Panther's detection unit electronics are defective. You must replace the electronics module in this case.

If you experience a sensor failure, this could also be due to defective detection unit electronics.

In Panther's diagnostics, a sensor failure is signalled by the Alarm A light when the Zone Switch is in position B.

If you experience a sensor fail, push the Reset button. If a sensor fail occurs more than once, you must replace the electronics module.

## Removing the Electronics Module

The electronics module is located behind the top door. It contains Panther's controls and indicators and all of the detection electronics. The electronics module can be easily removed by following the procedure given below.

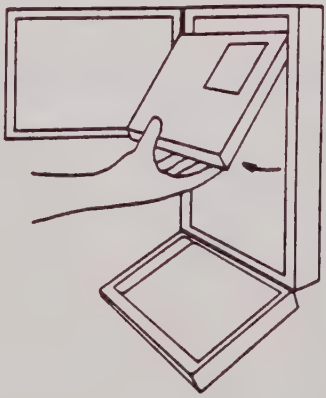
1. Disconnect the power. Disconnect the sensor cables and the ribbon cable from the electronics module.

2. Place your hand underneath the Tx and Rx connectors and grasp the bottom of the electronics module.

3. Unsnap the bottom of the electronics module from the housing by pulling firmly.

4. Swing the electronics module out and downward to remove it from the housing.

Removing Electronics Module



## Replacing the Electronics Module

To replace the electronics module, simply snap the module back into position and re-attach the sensor cables and the ribbon cable. Adjust the sensitivity.

# Replacing the Terminal Connection Module

**Why Replace the Terminal Connection Module**

If the terminal connection module suffers mechanical damage, or if the DIP switch fails, you must replace it.

**Removing the Terminal Connection Module**

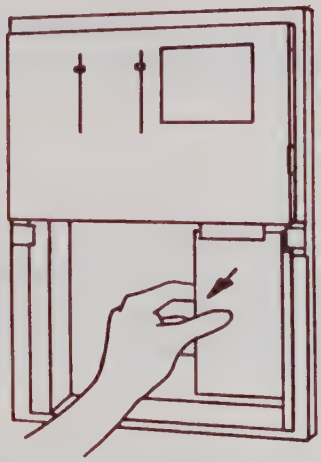
The terminal connection module is located behind the bottom door. It contains the option selection DIP switch and the 18-position terminal strip. You can remove the terminal connection module by following the simple procedure given below.

1. Disconnect the power and all other connections to the 18-position terminal strip. Label the wires prior to removal to simplify re-connection. Undo the retaining clips and disconnect the ribbon cable from the electronics module.

2. Grasp the terminal connection module with one hand.

3. Pull firmly to unsnap the module from the four standoffs attached to the housing. You'll find it easiest to unsnap from one standoff at a time.

Removing Terminal Connection Module



**Replacing the Terminal Connection Module**

To replace the terminal connection module, make sure the ribbon cable connector is at the top, and then snap the module back into position on the four standoffs. Re-attach the ribbon cable. Re-attach all of the connections to the 18-position terminal strip.

# Solving Input Supervision Faults

**What They Are**

Input supervision faults occur when a supervised remote input line (Reset, Test or External Tamper) is cut, or when any jumpers (JPR1-JPR3) are removed without inserting a supervision resistor. For more information on input supervision, refer to the section on Installing Input Supervision, in the chapter on Installing the Detection Unit.

In Panther's diagnostics, input supervision faults are signalled by the Power light when the Zone switch is in position B.

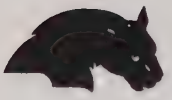
**Procedure**

Perform the following steps in order to verify that a line has been cut. If more than one remote input line is supervised, you will have to perform these steps on each line, in order to find the one causing the fault.

1. Disconnect the wires for the input line and the ground from the terminal strip.

2. Measure the resistance on the line. A normal resistance would have a value of 2.2 kΩ ± 5%.

3. If the line has been cut, the value should be infinite, indicating an open circuit. You will have to repair the line.



## Solving Test Failures

**What They Are**

Test failures occur when depressing the test switch fails to trigger the alarm lights and relays.

**Procedure**

If the test feature fails, perform the following steps:

1. Check that the oscillators have been set correctly (i.e., F1 and F2, or F1, F2 and F3).

2. If the oscillators are set correctly and the test still doesn't work, you'll have to replace the electronics module. See the section on Replacing the Electronics Module.

# Solving Alarm Failures

**What They Are**

Alarm failures occur when there are undetected intrusions in the zone(s) covered by the detection field. The failure is usually discovered during a walk test, or if an intrusion is detected by some other security device.

The main causes of alarm failures are listed below, along with procedures for solving them.

**Low Sensitivity**

If the sensitivity level is set too low, intruders won't be detected.

- Perform a cable walk in the required zone(s). Adjust the sensitivity level in one or both zones, as required. See the chapter on Starting Up and Setting Sensitivity for instructions.

**System Faults**

If there are any problems with the system (cable faults, rf interference, etc.), alarms might not be generated. System problems are signalled by the yellow Warning light.

- Refer to the section on Identifying Warning Alarms for instructions on dealing with system faults.

# Solving False Alarms

**What They Are**

False alarms are alarms that occur when there is no intrusion. They are signalled by the Alarm A or Alarm B light coming on.

The following outlines the common causes of false alarms, and how to solve them.

**High Sensitivity**

If the sensitivity level is too high, false alarms can be triggered by small animals. False alarms can be triggered by rainfall if your sensitivity is too high and your perimeter does not have good drainage. Sensitivity also increases when the ground freezes and thaws.

- Perform a cable walk in the required zone(s). Adjust the sensitivity level in one or both zones, as required. See the chapter on Starting Up and Setting Sensitivity for instructions.

**Water**

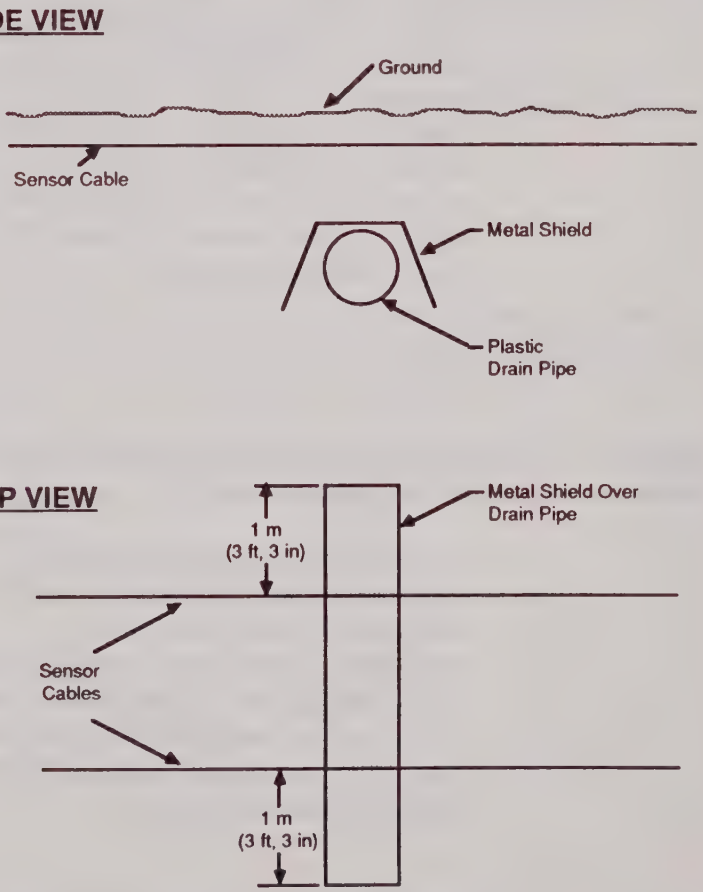
Puddles that are larger than 1 m wide by 1 cm deep (3 ft, 3 in wide by 3/8 in deep) can cause false alarms when the water moves.

- Fill the puddle with sand or other similar fine material.
- Landscape the area so the puddle drains properly.
- Close DIP switch SW-8 to change the detection velocity from 0.02 - 8 m/s to 0.04 - 8 m/s.

Water in a non-metallic drainage pipe can cause false alarms.

- Cover the drainage pipe with a one-piece metallic shield.

Drainage Pipe Covered with Metallic Shield



**Metallic Objects**

Moving metallic objects (such as pieces of wire more than 30 cm (1 ft) in length, a measuring tape, metal conduit, etc., left accidentally in the zone), can cause false alarms. Moving traffic in the detection field can also set off alarms. Buried metallic objects can distort the detection field and create an area of low sensitivity.

- Remove visible metallic debris.
- Check for buried debris with a metal detector and remove it if necessary.
- If the above solutions don't clear the alarms, the cables might be too close to moving traffic. Re-route the cables so that they are at least 4 m (13 ft) away from roads where there may be moving traffic. See the chapter on Laying Out the Cable Route for required separation distances.

**Metallic Fences**

Metallic fences can cause false alarms if they are in poor condition and if they move in the wind.

- Fasten the fence securely, if possible.
- If the fence is in poor condition, replace it (preferably with a non-metallic fence), or remove it.
- If the above solutions don't work, the cables might be too close to the metallic fence. Cables should never be closer than 2 m (6 ft, 6 in). Re-route the cables so that they are further from the fence. See the chapter on Laying Out the Cable Route for required separation distances.

Remember that cables cannot be routed **underneath** metallic fences.

**Buildings**

If the cables are placed too close to a building, the building will be included in the detection field. Any movement within the building will trigger an alarm.

- If a cable route ends while approaching a building wall at 90°, the terminators must be at least 7 m (22 ft, 9 in) from the wall. Re-route the cables if they are closer than this.
- If the cables run parallel to a building wall, they must be at least 2 m (6 ft, 6 in) from the wall. Re-route the cables if they are closer than this.

**Mutual Interference**

Other Panther units may cause false alarms from mutual interference, if they are not installed as outlined in the section on Separating Adjacent Panthers (Laying Out the Cable Route).

To eliminate false alarms caused by mutual interference, you must set the Panthers on different frequencies. This can be done in two ways.

**Units Less than Serial #5000**

If you have a unit with a serial number less than #5000, there are two frequencies available. Perform the following procedure on **one** of the units.

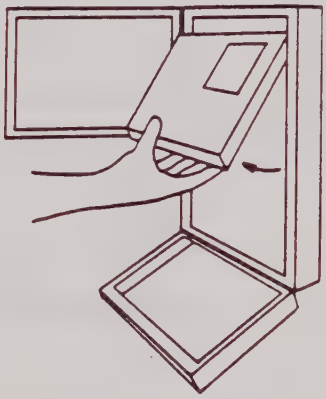
1. Disconnect the power. Disconnect the sensor cables and the ribbon cable from the electronics module.

2. Place your hand underneath the Tx and Rx connectors and grasp the bottom of the electronics module.

3. Unsnap the bottom of the electronics module from the housing by pulling firmly.

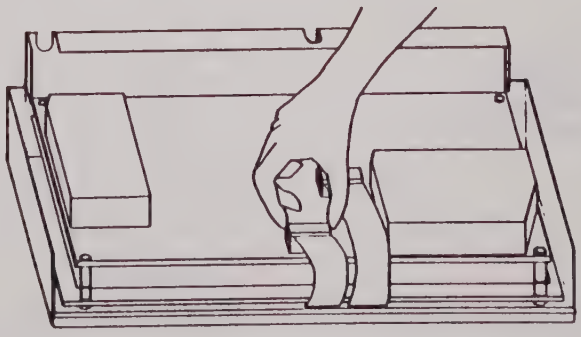
4. Swing the electronics module out and downward to remove it from the housing.

Removing Electronics Module



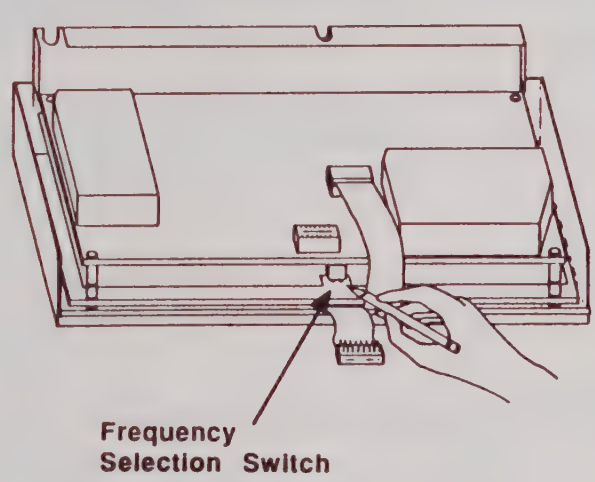
5. There are three ribbon cables on the back of the electronics module. Disconnect the cable that's attached closest to the top of the module.

Pulling off Ribbon Cable



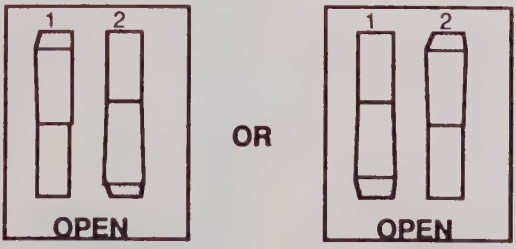
6. The two frequency selection switches are located under the ribbon cable, as shown below.

Location of Frequency Selection Switch




The frequency selection switches are set in one of two ways:

Settings for Frequency Selection Switch




F1
40.665 MHz

F2
40.695MHz

7. To change the frequency, reverse the positions of both switches. Use a pen or similar object to move the switches.

8. Replace the ribbon cable.

9. Replace the module. Snap it back into the housing and re-attach the sensor cables and the ribbon cable.

**Units with Serial #5000 or Greater**

If you have a unit with a serial number #5000 or greater, there are three frequencies available. To select the frequencies, change switches 9 and 10 on the option selection switch as follows:

| SW-9 | SW-10 | Frequency |
|---|---|---|
| O | O | F1 |
| C | O | F2 |
| O | C | F3 |
| C | C | OFF |

For more information on the option selection switch see page 7-34.

# Sample Installations

# *Sample Installations*


Case 1 - D. Coder Cable Co. 10-1
Case 2 - The Draconian Embassy 10-17

# Case 1 - D. Coder Cable Co.

**The Problem**

D. Coder Cable Co. has a fleet of vans that they use for their service operations. The vans contain expensive equipment and are parked overnight in the company parking lot. The company needs a security system that will detect intruders who attempt to tamper with the trucks. They want an alarm to be signalled at the alarm panel monitored by their night watchman.

**The Solution**

Bob Jones chose to install a Panther system around the asphalt parking lot. The vans are parked on top of the cables every night. Bob proposed that Panther be connected to the alarm panel located at the front entrance to the building.

**Key Points**

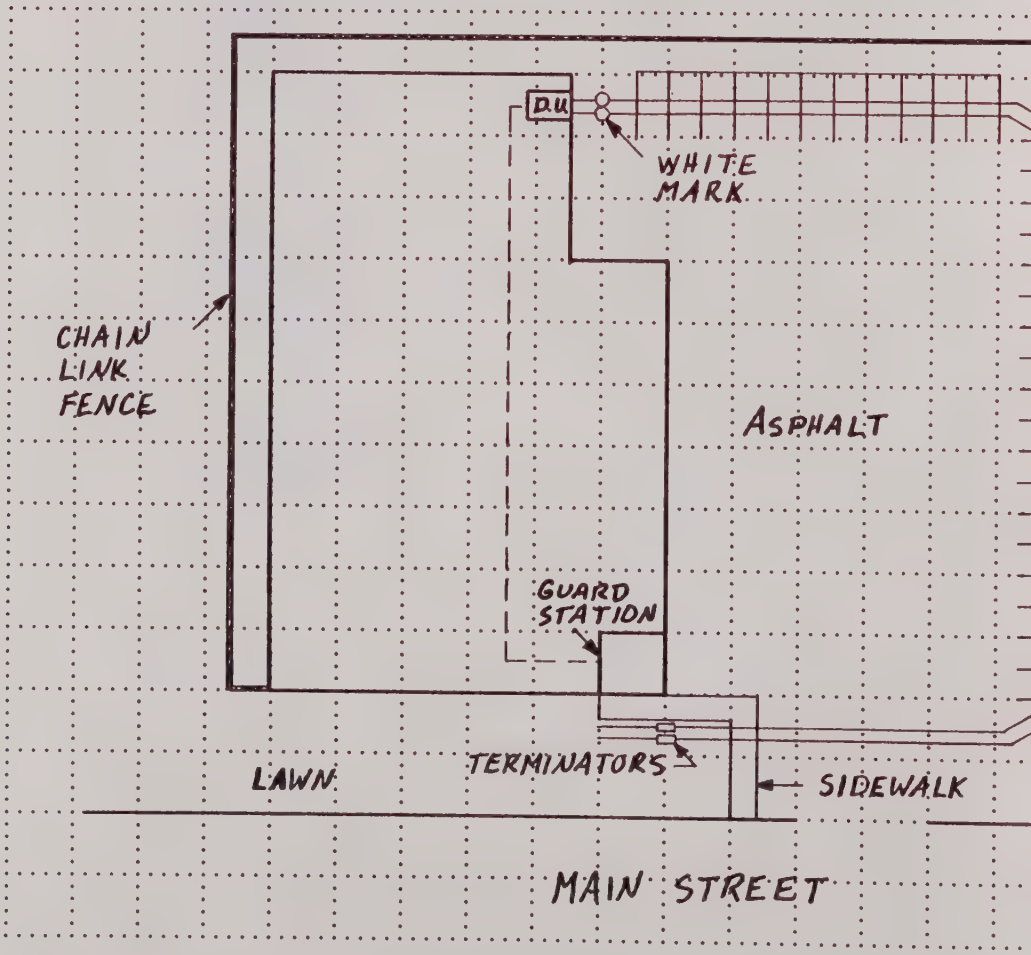
Bob drew a site plan and outlined the following points about the installation:

- A single zone would be installed in an open-loop configuration.
- Slots would be cut into the surface of the asphalt with a concrete saw.
- The slots would be sealed with Dow Corning 888.
- A 2 m (6 ft, 6 in) spacing was used for the cables.
- The outside cable was to be placed 5 m (16 ft, 3 in) from the chain link fence to minimize false alarms due to the fencing.
- The terminators were to be buried beneath the lawn at the front of the building.
- The installation had to be done on a weekend when the company was closed to minimize disruption to their daily business.

# Site Plan

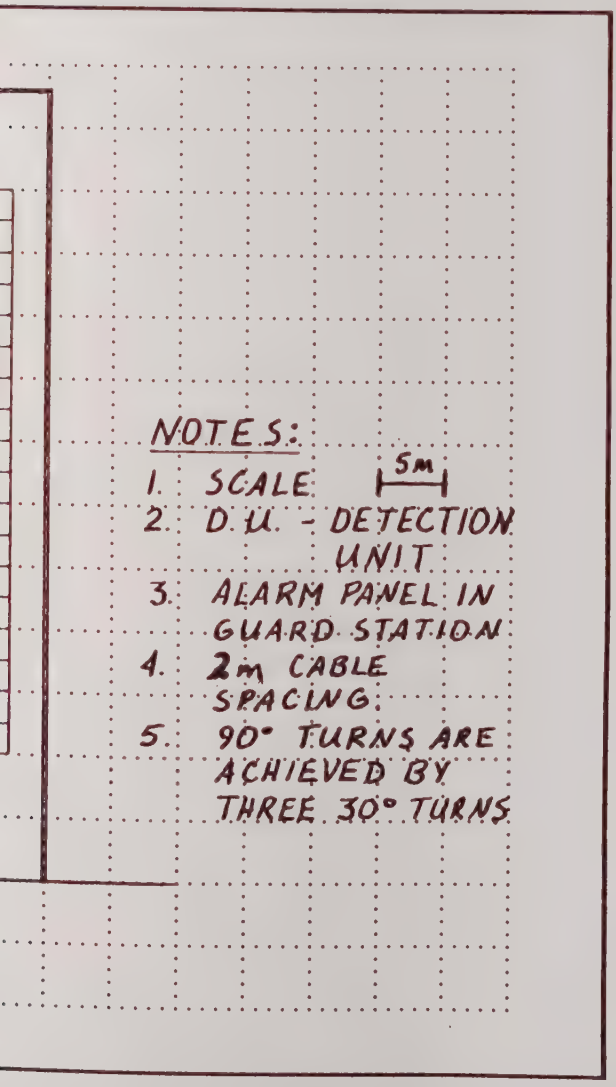
Panther™

**Customer:** D. CODER CABLE CO. **Prepared by:** BOB JONES




TM - Registered Trademark of Senstar Corporation

Date: MAY 15, 1987


NOTES:
1. SCALE 5m
2. D.U. - DETECTION UNIT
3. ALARM PANEL IN GUARD STATION
4. 2m CABLE SPACING
5. 90° TURNS ARE ACHIEVED BY THREE 30° TURNS

**Saturday, 9:00 a.m.:**

**Preparing the Site**

Bob arrived at the site with Fred Smith, his assistant. Fred measured the length of lead-in required inside the building. He also located and cleared the area where the detection unit would be mounted. At the same time, Bob walked the cable route with the site plan and checked for obstacles. He checked the area at the back of the building where the lead-in cable was to enter the building. A hole would have to be drilled into the foundation of the building close to ground level.

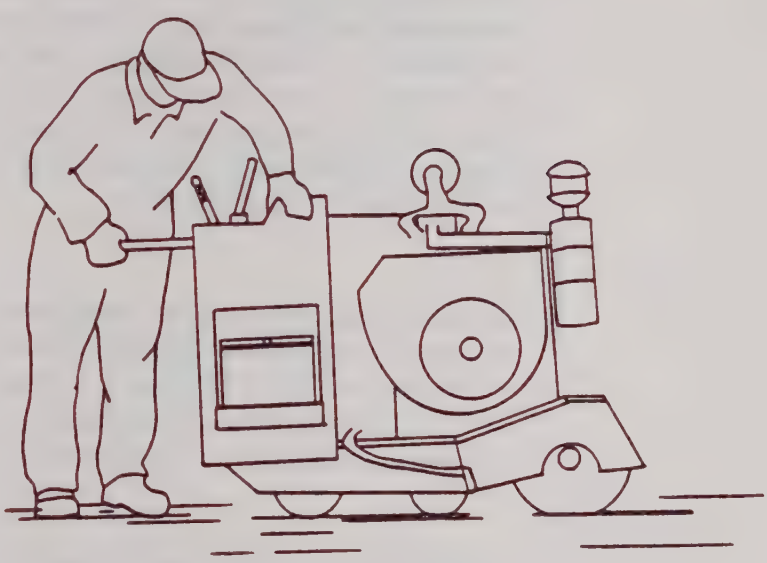
After Bob walked the proposed cable route, he marked it using a tape measure and some spray paint. To place the outside cable, he measured 5 m (16 ft, 3 in) from the chain link fence and 6 m (19 ft, 6 in) from the street. He used the procedures given in the chapter on Laying Out the Cable Route to turn the 90° corners.

Bob got out his Installer's Checklist and checked off each relevant item as he went.

**9:50 a.m.:**

## Cutting the Asphalt

Cutting Asphalt with Concrete Saw



Slots were cut into the asphalt using a concrete saw. The slots for both cables were cut according to the specifications given in the chapter on Installing the Cables.

**11:00 a.m.:** The area around the slots was swept clean.

**11:30 a.m.:** Bob used a push-pipe to tunnel under the sidewalk while Fred used a shovel to dig trenches in the soil for the terminators.

**12:30 p.m.:** **Lunch**

**1:00 p.m.:** **Checking the Cables**

The cables were tested for continuity according to the procedures given in the chapter on Installing the Cables. The lead-in cable was identified by stripping a cable end and looking for metal foil.

**1:15 p.m.:** **Laying the Cables**

The cables were dispensed from the cable caddies and laid into the slots. Care was taken to avoid damaging the cables as they were placed in the slots. Bob double-checked that the white mark on each cable was located in the spot indicated on the site plan. They immediately labeled the lead-in cables with one of the label sets. They labeled the outer cable "TXA" and inner cable "RXA".

**2:35 p.m.:** **Laying Sand**

A thin layer of sand was laid on top of the cables. Bob and Fred poured the sand directly from opened sand bags. After the sand was poured, they swept the area clean.

**3:15 p.m.:** **Installing the Terminators**

Bob and Fred installed a terminator on each cable. They used the instructions given in the chapter on Installing the Cable Fittings. They cut the cables to a length that allowed them to leave a little slack cable in the trenches. The trenches were filled and the sod replaced.

**3:45 p.m.:** **Sealing With Dow Corning 888**

Bob ensured that the slots were clean and dry, and then pumped Dow Corning 888 sealant into the slot. He used a pail with an air-powered pump to fill the slot to 6 mm (1/4 in) below the surface of the asphalt.

He applied the sealant to the cracks and joints 30 cm (12 in) on either side of the slot. He then removed the excess sealant from the asphalt surface.

**5:30 p.m.:** **End of the Day**

**Sunday, 9:00 a.m.:**

**Drilling the Cable Entrance and Mounting the Detection Unit**

Bob used a mortar drill to create a hole large enough to feed the lead-in cables into the building. While the drilling was going on, Fred mounted the detection unit on the wall. He used the instructions given in the chapter on Installing the Detection Unit.

Feeding the cables into the building presented no problems since the detection unit was to be mounted on the wall directly over the drilled hole. Conduit was used outside to cover the lead-in cables for the short distance from the asphalt to the hole. Conduit was also used to run the cables from the floor of the building into the bottom of the detection unit. A 2 m (6 ft, 6 in) service loop was left under the floor.

**9:45 a.m.:**

**Installing the Connectors**

Before Bob and Fred cut the cables to the proper length, they re-labeled them. They then installed the connectors on the lead-in cables at the detection unit. They used the procedures given in the chapter on Installing the Cable Fittings. Once the connectors were installed they measured each cable to test for the 130 kΩ terminator resistance. They didn't attach the connectors to the transmit and receive ports until after the next step.

**10:30 a.m.:** **Connection to the Alarm Panel and Power Supply**

Bob routed the wires that were to be connected to the alarm panel and the power supply through conduit. He then unpacked the terminal connection module from the detection unit carton and began to connect the wires that were to go to the alarm panel and power supply. The alarm panel required supervision resistors and so these were installed in the correct sockets on the terminal connection module. He used the instructions given in the chapter on Installing the Detection Unit.

Fred ran the wires through the false ceiling to the alarm panel and power supply at the front of the building. Conduit was used to cover the wires where they ran along the walls from the detection unit and the alarm panel.

Bob and Fred made all final connections but made sure that no power was applied to the Panther detection unit. There was only one zone at this site, so they connected the transmit and receive sensor cables to the TXA and RXA connectors at the detection unit. They attached a load set to the unused TXB and RXB connectors to provide rf termination, and to prevent those connectors from picking up stray signals and creating a cable-fault condition. They set the sensitivity for the 'B' zone to zero.

**11:40 a.m.:** **Lunch**

**12:30 p.m.:** **Initial Testing**

All the connections were tested by carrying out the functional test given in the chapter on Starting Up and Setting Sensitivity. The detection unit functioned normally.

**12:40 p.m.:** **Setting up the Chart Recorder**

Bob and Fred used the procedures given in the chapter on Starting Up and Setting Sensitivity to connect and calibrate their chart recorder. They used a dual-channel recorder even though there was only one detection zone at this particular site. All of the strip charts produced during the set-up procedure appeared as they were supposed to, so they began to prepare for the sensitivity-setting procedure.

**1:00 p.m.:**

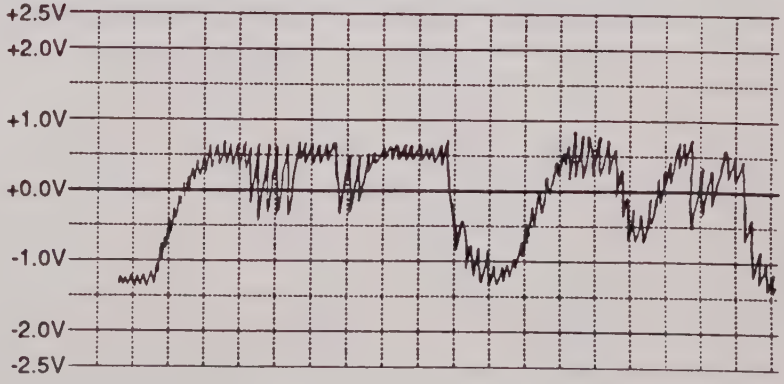
## Setting Sensitivity

The sensitivity was initially set by using the Sensitivity A control and the detection meter values indicated in the chapter on Starting Up and Setting Sensitivity.

Fred had never done a walk test before, so he volunteered to walk down the center of the cables. He communicated with Bob inside the building with a two-way radio. He started walking between the cables at the location of the buried white marks and continued until he'd walked 5 m (16 ft, 3 in) past the terminators. Then he waited until Bob signalled him to start walking back down the cables in the opposite direction. He made sure that he didn't stop until he was outside the zone, as this would upset the recording.

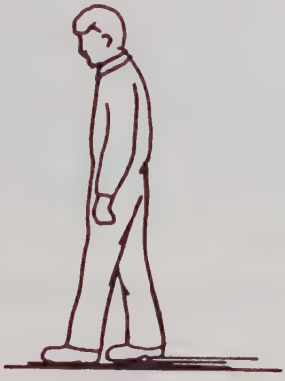
Fred's walk test produced the following chart recording:

Chart Recording of Walk Test



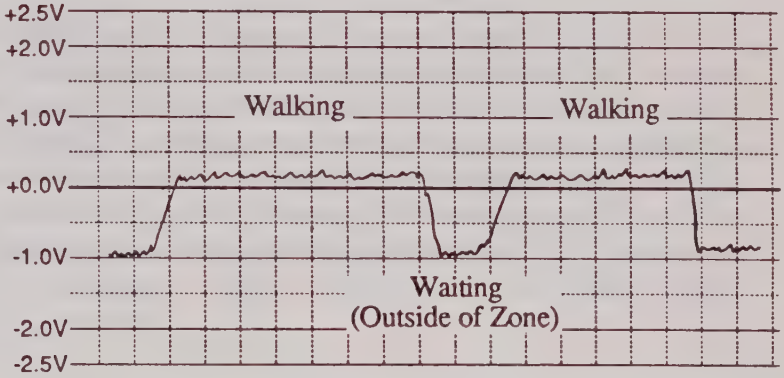
They noticed an unusually large number of sensitivity dips in the chart recording of Fred's walk test. They also noticed that it didn't take Fred long enough to walk the length of the zone. They concluded that he hadn't walked heel-to-toe and that the dips in sensitivity were false ones created by his fast pace. Bob showed Fred how to walk heel-to-toe and the walk test was repeated.

Walking Heel-to-Toe



The new walk test produced the following chart recording:

Chart Recording of New Walk Test




The walk test was judged satisfactory so they parked all of the vans on top of the cables. The sensitivity was re-adjusted according to the Vehicle Protection procedure in the chapter on Starting Up and Setting Sensitivity. After the sensitivity was re-adjusted, Bob was able to generate an alarm by walking between each van.

**2:15 p.m.:** **Customer Acceptance**

The system was demonstrated to the owner and the security guard who was on duty at the time. Bob did a crossing test and demonstrated the detection unit as indicated in the System Test procedure in the chapter on Starting Up and Setting Sensitivity. The owner and guard followed the sensitivity adjustment instructions given in the Panther Owner's Guide as the crossing test was performed. The guard was shown how Panther's alarms were to be processed on the alarm panel. The owner signed the acceptance and then was given both keys to the detection unit's top door.

**2:40 p.m.:** **Installation Complete**

## Case 2 - The Draconian Embassy

**The Problem**

The Draconian embassy is in need of increased security due to international tension centering around the country of Draconia. Embassy officials wish to avoid installing unsightly security fencing or increasing the number of armed guards stationed at their embassy (presently two guards). They want to avoid the appearance of increased security. The embassy is located in a rather exclusive neighborhood and there are local regulations requiring property owners to maintain an aesthetically pleasing environment.

**The Solution**

Bob Jones chose to install a Panther system around the perimeter of the embassy grounds. The Panther detection unit would be connected to an alarm panel located at the guard station inside the embassy near the front door. Panther would complement an already elaborate security system that includes interior passive infra-red sensors, microwave sensors and CCTV cameras.

**Key Points**

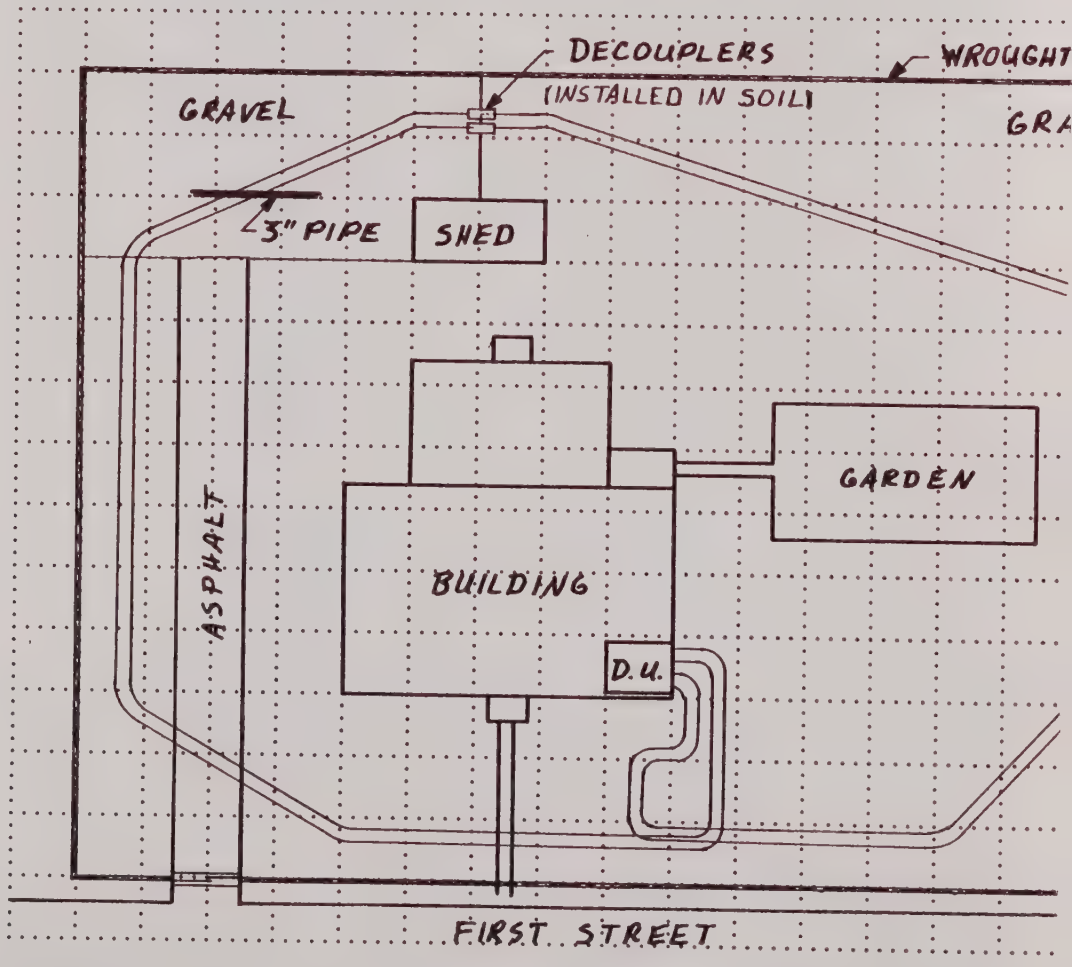
Bob drew a site plan and outlined the following points about the installation:

- Bob couldn't place the cables along the fence because the total fence perimeter is slightly larger than 300 m (984 ft).
- He had to route the cables around a septic system.
- A 300 m (984 ft) two-zone decoupled system was required to completely surround the embassy.
- Bob placed the decouplers at the gravel/soil transition.
- One zone crosses three types of mediums: soil, asphalt, and gravel. Bob realized that this was unavoidable, and so he decided to keep the sensitivity of the zone uniform by installing the cables beneath the asphalt.
- The installation had to be done quickly and could not leave any scars, so Bob decided to use a sod remover and a small trenching machine to install the cables.

# Site Plan

Panther™

**Customer:** DRACONIAN EMBASSY **Prepared by:** BOB JONES

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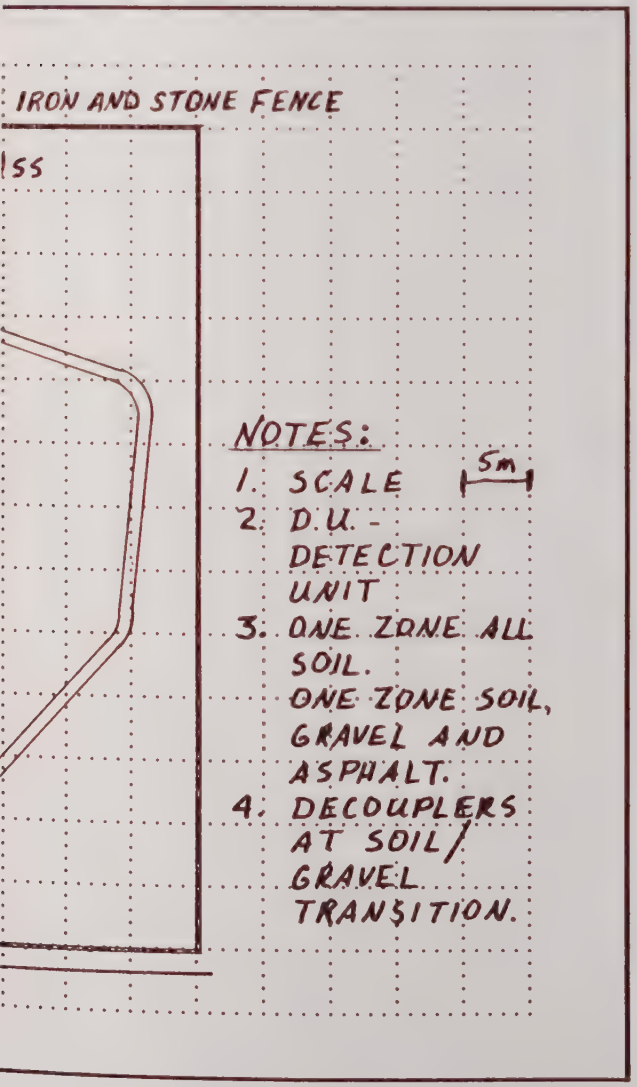
Date: MAY 10, 1987



**Monday, 8:00 a.m.:**

**Preparing the Site**

When Bob and Fred arrived at the site they unloaded and prepared the small trenching machine. Bob walked the cable route with the site plan and checked for obstacles. He checked the area at the side of the embassy where the lead-in cable was to enter. A hole would have to be drilled into the foundation of the building slightly above ground level.

At the same time, Fred measured the length of lead-in required inside the building. He also located and cleared the area where the detection unit would be mounted.

After Bob walked the proposed cable route, he marked the route using a tape measure and some spray paint. Bob used the trees and the driveway as references for placing the cables in the correct spots.

Bob referred to the chapter on Laying Out the Cable Route for the overlap dimensions. He made sure that the marked locations of the white marks on the cables were 8 m (26 ft) apart.

Bob got out his Installer's Checklist and checked off the relevant items as he went.

9:10 a.m.:

**Checking the Cables**

The cables were tested for continuity according to the procedures given in the chapter on Installing the Cables. The lead-in cable was identified by stripping the end of the cable and looking for metal foil.

9:30 a.m.:

**Installing the Overlap**

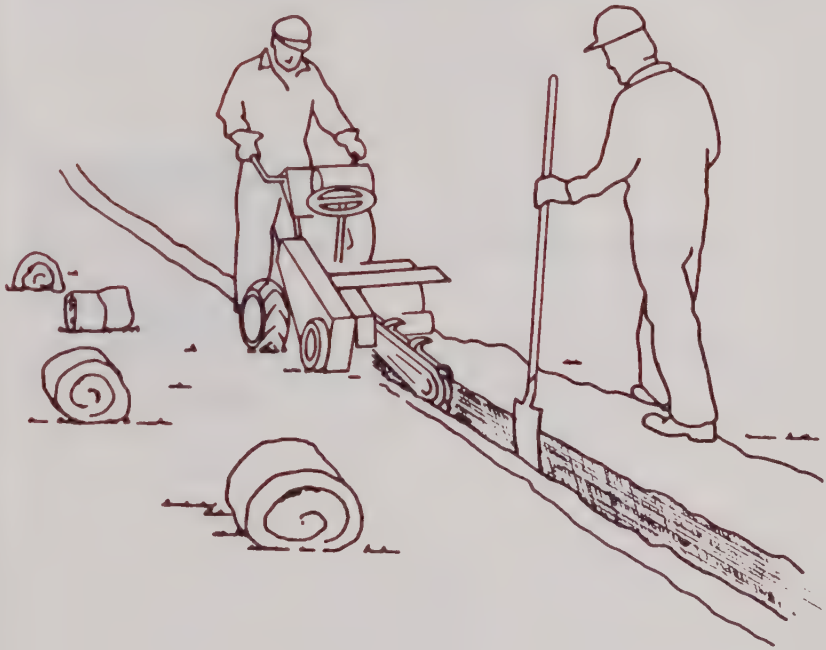
The overlap was installed before the rest of the cable route.

Bob and Fred removed and rolled up the sod along the cable route at the zone overlap.

Removing the Sod

Then they dug the trenches for the overlap only. While digging, they used a marked shovel to make sure the trench stayed at the proper depth.

Digging the Trenches



They slid ten ferrite beads onto the lead-in section of each cable, fastening them at the correct distance from the white mark with the retainers.

They placed the cable in the trenches and made sure the white marks were lined up according to the specifications on the site plan and those found in the chapter on Installing the Cables. They labeled each of the cables, ensuring that the outer cables were labeled transmit and the inner ones receive.

The remaining cable for both zones was left coiled in the cable caddies. The lead-in cable that was to be run into the building was coiled and left near the proposed entrance area.

**12:30 p.m.:** **Lunch**

1:00 p.m.:

**Digging One Trench for Zone B**

The cables were installed one at a time. In other words, sod was removed, one trench was dug, a cable buried in the trench and the sod replaced. Then the whole process was repeated for the other cable. They used this method because:

- The trenches didn't have to be left open for long periods of time, therefore reducing the possibility of damage to the cables.
- Wet weather was a possibility, but they knew that they would have time to install at least one cable before it rained.
- The trenching machine has a tendency to get caught in open trenches.

They also installed one whole zone before starting on the other zone. A small length of trench was left open where the decouplers were to be placed.

First, they installed the zone that goes around the garden to the back of the lot (Zone B). They followed the procedures for installing in soil given in the chapter on Installing the Cables. While Bob removed the sod with a sod cutter, Fred rolled up the sod behind him.

**1:30 p.m.:** **Laying Cable**

While Fred was digging the trench, Bob began unrolling the cable and placing it in the trench. He checked the depth every 30 cm (1 ft) and packed dirt around the cable every few meters to keep the cable in the trench. He also inspected the cable for damage as he went.

**1:45 p.m.:** **Restoring the Ground**

When the trenching and cable laying was complete, they began backfilling the trench and replacing the sod. Bob manned the shovel while Fred replaced the sod behind him. Excess dirt on the ground was spread out with a grass rake.

**2:40 p.m.:** **Installing the Other Cable in Zone B**

They installed the remaining cable in zone B using the same procedure they used for the first cable. When the crew was done, only an expert observer could tell where cables had been buried in the lawn.

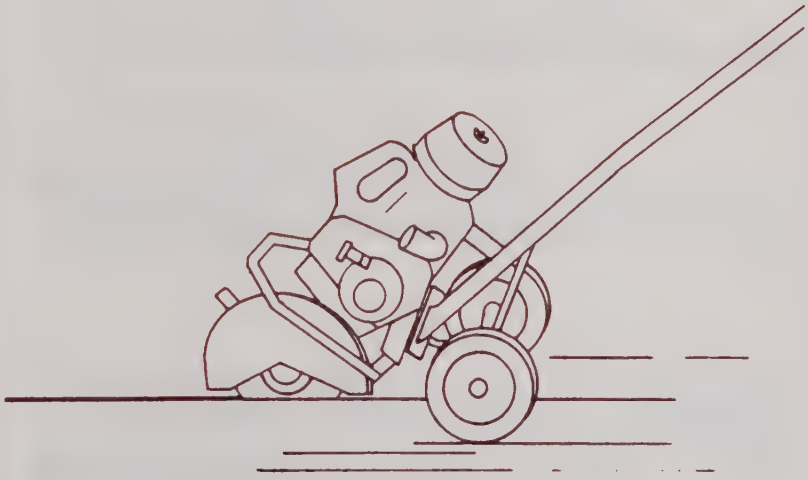
**5:00 p.m.:** **End of the Day**

**Tuesday, 8:00 a.m.:**

## Cutting the Asphalt and Digging in Gravel

Bob and Fred began the day by installing the first cable for zone A. They each took different duties. Bob began digging trenches in the gravel with the trenching machine (starting at the decoupler location), while Fred used a small asphalt cutter to remove a section of asphalt from the driveway.

Small Asphalt Cutter



A section of asphalt about 1.5 m (4 ft, 11 in) wide was removed. This width accommodates the 1 m (3 ft, 3 in) cable spacing and still leaves room for the width of the trenches. Sections of asphalt were pulled out with a pick axe.

While digging in the gravel, Bob discovered a 6 cm (3 in) pipe buried just below the level where the cables were to be buried. Using a shovel, a metal detector, and a utility map, he discovered that it was an empty metal pipe about 10 m (32 ft, 9 in) long. Rather than dig it up, he marked its location on the site plan and continued trenching.

**9:15 a.m.:** **Digging the Trenches in Soil**

Bob finished trenching in the gravel before the asphalt could be removed, so he continued by removing the sod from the lawn along the driveway. He then trenched along the cable route until he reached the asphalt driveway.

**10:30 a.m.:** **Digging Trenches Under the Asphalt**

Bob began trenching where the asphalt had been removed. He dug slightly deeper than he did in the soil because he wanted to lay the cables on a thin bed of sand. He followed the instructions for burying cable beneath concrete/asphalt that are given in the chapter on Installing the Cables.

Fred began laying the cable in the trench. He used the same technique that he and Bob used to install the other zone.

**11:30 a.m.:** **Lunch**

**12:15 p.m.:** **Backfilling the Trenches**

The trenches were backfilled and the sod replaced. The gravel was raked so that the marks left by the trenching would be less conspicuous. The trenches under the asphalt were filled with sand to the level where the asphalt started. Bob and Fred followed the guidelines given in the chapter on Installing the Cables.

**1:10 p.m.:** **Installing the Other Cable in Zone A**

Bob and Fred used the same procedure that they used to install the first cable in zone A, except they didn't have to remove any asphalt because it had been removed before the first cable was installed.

**3:00 p.m.:** **Restoring the Asphalt**

After backfilling the second cable in zone A, Bob called a paving sub-contractor to arrange for restoration the next day.

**4:00 p.m.:** **Installing the Decouplers**

Bob and Fred each installed one decoupler. They used the procedures given in the chapter on Installing the Cable Fittings. After they installed the decouplers, they tested for the 130 k resistance and then buried them.

**5:00 p.m.:** **End of the Day**

**Wednesday, 8:00 a.m.:**

**Drilling the Cable Entrance and Mounting the Detection Unit**

Bob used a mortar drill to create a hole large enough to feed the lead-in cables into the building. While the drilling was going on, Fred mounted the detection unit enclosure on the wall. He used the instructions given in the chapter on Installing the Detection Unit.

Feeding the cables into the building presented no problems since the detection unit was to be mounted on a wall in the basement directly under the drilled hole. Conduit was used outside to cover the lead-in cables for the short distance from the ground to the hole. A 2 m (6 ft, 6 in) service loop was left in the false ceiling in the basement.

**8:30 a.m.:**

**Asphalt Restoration**

The sub-contractor arrived and patched the asphalt. Since the patch was small, it did not take very long to do.

**8:45 a.m.:**

**Installing the Connectors**

Before they cut the cables to the proper length, they re-labeled the transmit and receive cables (trimming to length would remove the labels already on the cables). They installed connectors on the lead-in cables at the detection unit. They used the procedures given in the chapter on Installing the Cable Fittings. They didn't attach the connectors to the transmit and receive ports until later, but they did test for the 130 k decoupler resistance on the cables.

9:30 a.m.:

**Connecting to the Alarm Panel and Power Supply**

Fred routed the wires that were to go to the alarm panel and the power supply through conduit. He then unpacked the terminal connection module from the detection unit carton and began to connect the wires that were to go to the alarm panel and the power supply. The alarm panel required supervision resistors so Fred installed them in the correct sockets on the terminal connection module. He used the instructions given in the chapter on Installing the Detection Unit.

Bob ran the wires along the basement ceiling and up through the floor to the alarm panel and power supply at the front entrance of the building. Conduit was used to cover the wires where they ran from the floor to the alarm panel.

Bob then connected the ground wire to the detection unit and ran it outside. He drove a ground rod into the soil and securely attached the ground wire, cutting off the excess. They made all final connections but made sure that no power was applied to the Panther detection unit.

**10:30 a.m.:**

**Initial Testing**

All the connections were tested by carrying out the functional test given in the chapter on Starting Up and Setting Sensitivity.

When power was applied, they noticed that the Warning light came on and stayed on. Bob and Fred entered Panther's diagnostics to determine the meaning of the light. They followed the procedures outlined in the Identifying Warning Alarms section of the Troubleshooting and Repair chapter.

In diagnostics, the Warning light came on when the Zone switch was in the A position. This indicated a transmit cable fault.

**10:45 a.m.:** **Troubleshooting**

Bob and Fred went back outside to dig up the transmit cable, in order to find the damaged portion of the cable. They noticed a section where cables for new outside lighting had just been laid by another contractor. They carefully uncovered the soil in the area and noted a large gash in that section of the transmit cable.

The men repaired the cable, following the procedures for repairing severe cable damage, in the Troubleshooting and Repair chapter. They then re-installed the cable in the ground.

Fred marked the location of the damaged section on the site plan.

They then performed the functional test again, according to the procedures in the chapter on Starting Up and Setting Sensitivity. This time, no alarms occurred.

**12:30 p.m.:** **Lunch**

**1:00 p.m.:**

**Setting up the Chart Recorder**

They used the procedures given in the chapter on Starting Up and Setting Sensitivity to connect and calibrate their chart recorder. They used a dual-channel recorder so that they could observe both zones at the same time. All of the strip charts produced during the set-up procedure were normal, so they began to prepare for the sensitivity-setting procedure.

1:30 p.m.:

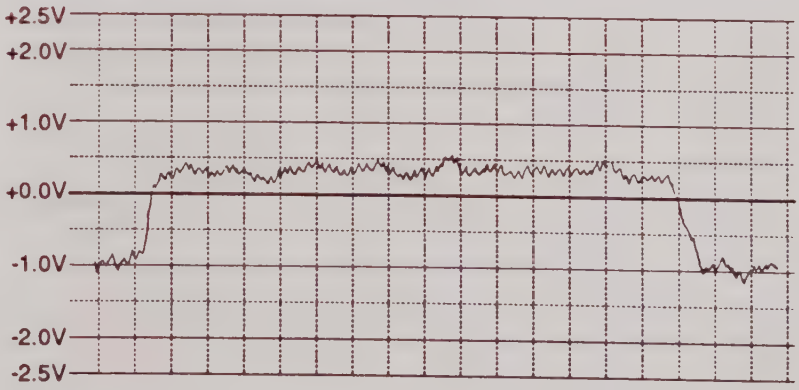
**Setting Sensitivity for Zone B**

The sensitivity was initially set by using the Sensitivity B control and the detection meter values indicated in the chapter on Starting Up and Setting Sensitivity.

Bob performed a walk test by walking heel-to-toe down the center of the cables while Fred watched the chart recorder inside. The two communicated with a two-way radio. After going past the decouplers, Bob waited for twenty seconds before walking back down the cables in the opposite direction.

The walk test produced a perfect chart recording and so no further adjustment was required.

Chart Recording of Walk Test



**2:15 p.m.:**

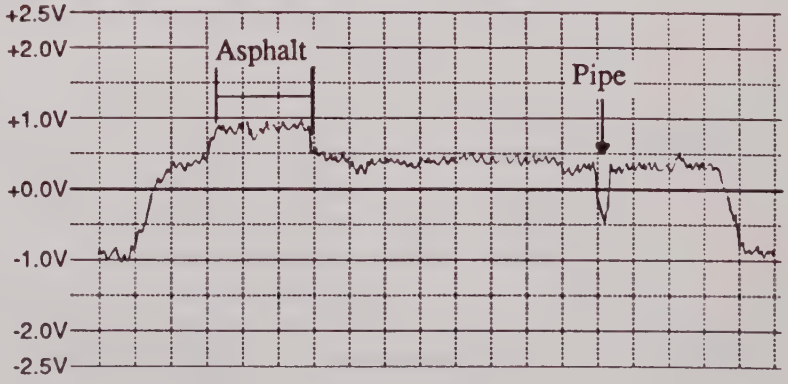
**Setting Sensitivity for Zone A**

The sensitivity was initially set by using the Sensitivity A control and the detection meter values indicated in the chapter on Starting Up and Setting Sensitivity.

Bob performed the walk test while Fred watched the chart recorder. They used the procedure given in the chapter on Starting Up and Setting Sensitivity.

When the walk test was complete, the strip chart showed a dip in sensitivity in the gravel parking lot. The dip appeared on both passes. It was obvious that the dip was being caused by the buried pipe that had been found while trenching in the gravel.

Low Spot Due to Buried Pipe



The walk test also showed slightly higher sensitivity along the asphalt driveway and the gravel parking lot. However, sensitivity variations are normal when passing from one medium to another. These particular variations did not present a problem.

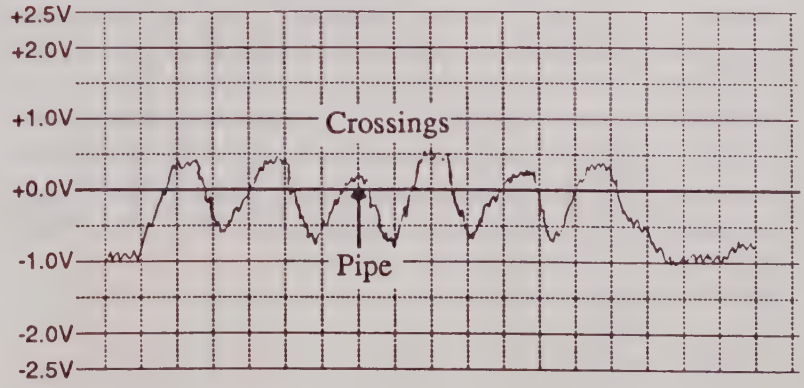
3:00 p.m.:

**Doing a Crossing Test**

Bob performed a crossing test at the location of the buried pipe. Each time he crossed the cables, the strip chart showed readings higher than 0.0 Vdc, which meant that he was detected in spite of the reduced sensitivity in that area. They decided it was not necessary to remove the pipe.

If they had encounted problems with the dip, they could have raised the cables a few inches closer to the surface in the area near the pipe. Throughout this test they referred to the procedures for improving sensitivity given in the chapter on Starting Up and Setting Sensitivity.

Crossing Test



**3:25 p.m.:** **Customer Acceptance**

The system was demonstrated for the embassy's head of security and his staff. Bob did a crossing test and demonstrated the detection unit as indicated in the System Test procedure in the chapter on Starting Up and Setting Sensitivity. The security personnel followed the sensitivity adjustment instructions given in the Panther Owner's Guide as the crossing test was performed. They were shown how Panther's alarms were to be processed on the alarm panel. The head of security signed the customer acceptance and was then given both keys to the detection unit's top door.

**4:15 p.m.:** **Installation Complete**

# Installer's Checklist

# Installer's Checklist

# Installer's Checklist

1. **Check the system design:**
(Pg. 3-1 to 3-16)

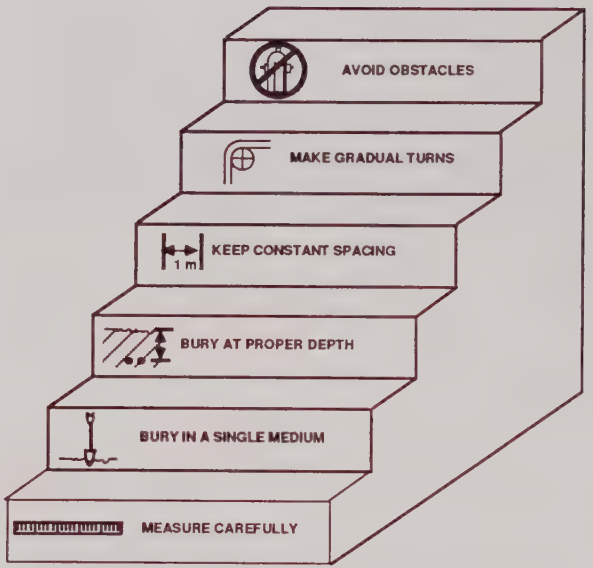
- ☐ check the site plan measurements (Pg. 3-15)
- ☐ use newest equipment and techniques (Pg. 3-15)
- ☐ look for design errors (Pg. 3-16)

2. **Check your tools and parts supply:**
(Pg. 3-17 to 3-26)

- ☐ standard parts (Pg. 3-17)
- ☐ sufficient spare parts (Pg. 3-18)
- ☐ repair and accessory items (Pg. 3-18)
- ☐ standard tools (Pg. 3-19)
- ☐ cable burial tools (Pg. 3-19)
- ☐ damp weather tools (Pg. 3-20)

3. **Review connector procedures:**
(Pg. 4-1 to 4-30)

- ☐ installing connectors (Pg. 4-1 to 4-14)
- ☐ installing terminators (Pg. 4-21 to 4-25)
- ☐ installing decouplers (Pg. 4-26 to 4-30)
- ☐ making splices and repairs (Pg. 9-14 to 9-37)
- ☐ waterproofing connections (see terminators/decouplers)




The Golden Rule - Make Good Connections

6. **Route the sensor cables:** (Pg. 5-3 to 5-48)

- ☐ refer to the handbook for corner dimensions (Pg. 5-3 to 5-33)
- ☐ mark the sensor cable paths with stakes, paint or string (Pg. 6-11, 6-15, 6-21)
- ☐ mark the location of the 'white marks' (Pg. 5-35 to 5-39)
- ☐ mark the sensor cable entrance to the building

4. **Prepare the site:** (Pg. 5-1 to 5-2)

- ☐ ensure that the site matches the site plan (Pg. 5-1)
- ☐ clear debris from the sensor cable paths (Pg. 5-1)
- ☐ clear the area near the detection unit location (Pg. 5-1)

5. **Check for obstacles:** (Pg. 5-40 to 5-45)

- ☐ metal fences (Pg. 5-42 to 5-43)
- ☐ buildings (Pg. 5-44)
- ☐ standing water (Pg. 5-44)
- ☐ metallic debris (Pg. 5-42 to 5-44)
- ☐ buried walls (Pg. 5-45)
- ☐ underground wiring (Pg. 5-45)
- ☐ bypass problem areas (Pg. 5-40 to 5-44)
- ☐ separate adjacent Panthers (Pg. 5-46 to 5-48)

7. **Prepare the cables prior to burial:** (Pg. 6-5 to 6-7)

- ☐ test the cables for continuity and short circuits (Pg. 6-5)
- ☐ lay the cables along the proposed route with the non-detecting section near the detection unit (Pg. 6-6)
- ☐ check for jacket damage, repair if necessary (Pg. 6-7)
- ☐ label the lead-in ends of all the cables (Pg. 6-6)
- ☐ fasten 10 ferrite beads onto the non-detecting section of each sensor cable, properly spaced (Pg. 6-8 to 6-10)
- ☐ lay out the zone overlap area if required (Pg. 5-35 to 5-39)

**8. Cut a channel for the cable:** (Pg. 6-1 to 6-4)

- ☐ slit grass with a spade or sod slitter (Pg. 6-12 to 6-13)
- ☐ dig trenches in soil (Pg. 6-12 to 6-13)
- ☐ dig trenches in gravel (Pg. 6-16 to 6-17)
- ☐ saw slots into concrete or asphalt (Pg. 6-23 to 6-24)
- ☐ cut and remove thin asphalt (Pg. 6-25)
- ☐ dig trenches below thin asphalt (Pg. 6-25)
- ☐ lay cable
- ☐ use sand to protect cable (Pg. 6-13, 6-16)

**13. Install the modules:** (Pg. 7-7 to 7-40)

- ☐ install the electronics module (Pg. 7-7)
- ☐ install supervision resistors on the terminal connection module if required (Pg. 7-21 to 7-27)
- ☐ enable input supervision if required (Pg. 7-29 to 7-33)
- ☐ coil a lead-in cable service loop
- ☐ attach connectors to the lead-in cable (Pg. 4-1 to 4-14)
- ☐ label the cables
- ☐ make the alarm relay connections to the terminal connection module (Pg. 7-8 to 7-17)
- ☐ install the terminal connection module (Pg. 7-17)
- ☐ connect the sensor cables to the detection unit (Pg. 7-

4. **Prepare the site:** (Pg. 5-1 to 5-2)

- ☐ ensure that the site matches the site plan (Pg. 5-1)
- ☐ clear debris from the sensor cable paths (Pg. 5-1)
- ☐ clear the area near the detection unit location (Pg. 5-1)

5. **Check for obstacles:** (Pg. 5-40 to 5-45)

- ☐ metal fences (Pg. 5-42 to 5-43)
- ☐ buildings (Pg. 5-44)
- ☐ standing water (Pg. 5-44)
- ☐ metallic debris (Pg. 5-42 to 5-44)
- ☐ buried walls (Pg. 5-45)
- ☐ underground wiring (Pg. 5-45)

- ☐ bypass problem areas (Pg. 5-40 to 5-44)
- ☐ separate adjacent Panthers (Pg. 5-46 to 5-48)

7. **Prepare the cables prior to burial:** (Pg. 6-5 to 6-7)

- ☐ test the cables for continuity and short circuits (Pg. 6-5)
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- ☐ lay out the zone overlap area if required (Pg. 5-35 to 5-39)

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- ☐ lay cable
- ☐ use sand to protect cable (Pg. 6-13, 6-16)

**9. Attach the terminators/decouplers:** (Pg. 4-21 to 4-30)

- ☐ trim the detecting section of the cables to length (leave some slack) (Pg. 4-6 to 4-8)
- ☐ attach terminators or decouplers, as required (Pg. 4-21 to 4-30)
- ☐ allow for cable strain relief (Pg. 4-5)

**10. Run the interior lead-in:** (Pg. 6-45 to 6-47)

- ☐ drill a hole in the wall of sufficient size for cables, attach conduit if desired (Pg. 6-46)
- ☐ feed lead-in cable from exterior to interior (Pg. 6-46)
- ☐ run lead-in from entrance hole to detection unit, use conduit if desired (Pg. 6-47)
- ☐ leave a service loop (Pg. 6-47)

**11. Mount the detection unit:**

**13. Install the modules:** (Pg. 7-7 to 7-40)

- ☐ install the electronics module (Pg. 7-7)
- ☐ install supervision resistors on the terminal connection module if required (Pg. 7-21 to 7-27)
- ☐ enable input supervision if required (Pg. 7-29 to 7-33)
- ☐ coil a lead-in cable service loop
- ☐ attach connectors to the lead-in cable (Pg. 4-1 to 4-14)
- ☐ label the cables
- ☐ make the alarm relay connections to the terminal connection module (Pg. 7-8 to 7-17)
- ☐ install the terminal connection module (Pg. 7-17)
- ☐ connect the sensor cables to the detection unit (Pg. 7-38 to 7-40)
- ☐ DO NOT apply dc power yet
- ☐ set the option selection switch (Pg. 7-34 to 7-37)

**14. Test the system:** (Pg. 8-1 to 8-47)

- ☐ check previous work before connecting dc power (Pg. 8-8)
- ☐ apply dc power (Pg. 8-8 to 8-10)
- ☐ do initial test of detection unit (Pg. 8-10 to 8-12)
- ☐ if there are any problems, use diagnostics (Pg. 9-1 to 9-53)
- ☐ set up chart recorder (Pg. 8-13 to 8-17)
- ☐ set sensitivity for each zone using walk test (Pg. 8-18 to 8-28)
- ☐ mark test crossing points on site plan

**15. Clean up, do final check:** (Pg. 8-40 to 8-47)

(Pg. 7-1 to 7-5)

- ☐ unpack all detection unit parts (Pg. 7-4)
- ☐ install bushings on the housing (Pg. 7-4)
- ☐ mount the housing on the wall (Pg. 7-4 to 7-5)

**12. Install adequate grounding for all components:** (Pg. 7-6)

- ☐ attach ground wire to housing (Pg. 7-6)
- ☐ DO NOT attach ground wire to ac or dc grounds (Pg. 7-6)
- ☐ run ground wire to buried ground rod (earth ground) (Pg. 7-6)

- ☐ remove debris from exterior and interior areas
- ☐ seal the entrance hole, patch any other openings
- ☐ double-check all connections
- ☐ set the option selection switch as desired (Pg. 7-34 to 7-37)
- ☐ place copy of site plan in Owner's Guide (Pg. 8-46)

**16. Obtain customer sign-off:** (Pg. 8-43 to 8-47)

- ☐ walk the cable route with the customer (Pg. 8-43)
- ☐ explain and demonstrate system (Pg. 8-44 to 8-46)
- ☐ demonstrate use of the detection meter (Pg. 8-43 to 8-46)

# Glossary

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**Adaptive Detection Methodology** — automatic compensation for environmental changes. Panther is a "smart" alarm system that can adapt itself to changing background conditions. Manual re-adjustment is not required since Panther adjusts automatically.

**Alarm Condition** — a threatening condition, such as an intrusion

**Alarm Latching** — locking of alarms so that when the triggering condition is removed, you must push the Reset switch to turn off the lights and deactivate the relays. If an alarm is unlatched, the lights go off and the relays are automatically activated as soon as the triggering condition is removed. Alarm latching is done at the alarm panel.

**Alarm Panel** — equipment which activates a visible or audible alarm device and provides system controls. The Panther detection unit does not have a built-in horn, buzzer or other alarm "annunciator". It has all of the necessary signal and control lines to allow connection to an annunciator panel.

**Alarm Trip Point** — voltage level (0.0 Vdc) above which an alarm is triggered

**Attenuation** — a reduction in the Panther sensitivity. Under some rare circumstances, the Panther radio-frequency signal is too powerful. For these situations, built-in "attenuators" can be activated to reduce the signal level.

**Boring Machine** — a power-driven machine used to tunnel beneath paved surfaces. Where Panther sensor cables must cross a paved surface, such as a sidewalk, the cables can be passed through a hole bored beneath the surface.

**Burial Medium** — the soil, concrete, or asphalt in which the Panther sensor cables are buried. Ideally, each zone should be buried in a single medium to simplify the adjustments that optimize the sensitivity.

**Bypass** — a non-detecting section of a normally detecting zone. A section of non-detecting cable is spliced into the middle of the zone, producing a non-detecting area with no field strength. See Field Strength, Non-Detecting Area.

**Channel** — the slot, trench, or tunnel that contains the sensor cable

**Chart Recorder** — used for calibrating zones. It provides a permanent record of Panther's sensitivity along the length of each zone.

| | |
|---|---|
| **Closed Loop** | a perimeter which closes upon itself. Used to surround the valuables to be protected. |
| **Centimeter (cm)** | 1 centimeter = 3/8 inches = 0.01 meters |
| **Decoupled Loop** | closed loop formed by joining the ends of the sensor cables in Zone A to the ends of the sensor cables in Zone B |
| **Decoupler** | a device used for joining the ends of two zones together. It prevents the radio-frequency signals from the two zones interfering with each other while providing full-strength overlapping coverage at the joint. |
| **Detecting Section** | the section of the sensor cables which emits and receives the radio-frequency signals. Note that the detecting section of the sensor cables does not have a uniform interior construction throughout its length. |
| **Detection Field** | the area in which an intruder will be detected. For Panther, the detection field exists primarily between the two sensor cables. However, it also extends above and below ground as well as some distance to the outside of both cables. This results in a detection field with an oval cross-section. |

**Detection Meter**

an indicator of detection activity. The Panther detection unit has a detection meter on the front panel which allow adjustment of the sensitivity without any tools or equipment. It also provides visual confirmation of proper system operation.

**Detection Range**

see Detection Field

**Detection Unit**

the control panel which generates the detection signals, analyzes disturbances, and raises alarms when appropriate

**Diagnostics**

troubleshooting feature of Panther. When the Warning light comes on, Panther's diagnostics feature specifies which of eight alarm conditions have caused the alarm.

**Discrimination**

the ability to detect intruders while ignoring everything else. Panther can be set to detect intruders as light as 20 kg (44 lb), although the normal setting is based on a 70 kg (154 lb) intruder.

**Disturbance**

the affect of an intruder on the detection field. The size of the disturbance indicates the size of the intruder. Metallic objects, such as firearms, cause a large disturbance.

**Dow Corning 888**

one brand of sealant which may be used when the sensor cables are placed into slots in pavement. See 3M Traffic Loop Sealant.

**Electromagnetic Cross-Section or ECS**

a measure of the "detectability" of an object. Objects with a small ECS, such as wood or plastic, are not usually detected by Panther. Panther can easily detect objects with a large ECS, such as humans, automobiles, or other metallic or water-filled objects.

**Electronics Module**

located in the top of the Panther detection unit. It contains the controls to set the sensitivity and signal alarms.

**EOL**

"end of line". See Supervision Resistor, Line Supervision.

**False Alarm**

an alarm signal transmitted in the absence of an alarm condition

**Ferrite Beads**

small metallic "collars" that are slid onto the non-detecting lead-in cable during installation to stop the detection field. Without the beads, the detection field may stray along the lead-in towards the detection unit.

**Field-Start Section**

the 4 m (13 ft) section of the sensor cables where the detection field builds up strength. This section of the cable is ported, and is situated between the non-detecting and detecting sections. These sections are always overlapped to compensate for the partial strength field. Intruders may or may not be detected in this area.

**Field Strength**

a measure of Panther sensitivity. The field strength varies along the length of the sensor cables. There is zero field strength on the non-detecting "lead-in" section. The field builds to full strength in the 4 m (13 ft) field-start section of the cable, and stays at full strength to the end of the cable. At the cable end, there is either a decoupler or a terminator. In both cases, the field strength drops to zero about 4 m (13 ft) beyond the cable end. In some rare instances, a non-detecting section of cable is spliced into the middle of a (normally detecting) zone, producing a non-detecting area (or bypass) with no field strength.

**Flooding**

a sticky chemical coating designed to prevent the entry of water. The braided shield of each sensor cable is soaked with "flooding" during manufacture.

**Foot (ft)**

1 foot = 0.3048 meters

**Inch (in)**

1 inch = 2.54 centimeters

| | |
|---|---|
| **Input Supervision Fault** | occurs when a supervised remote input line is cut |
| **Intruder** | a person entering or attempting to enter a secure area without authorization. Panther can be set to detect intruders as light as 20 kg (44 lb), although the normal setting is based on a 70 kg (154 lb) intruder. |
| **Irreparable Damage** | a damaged section of sensor cable more than 3 m (9 ft, 9 in) in length |
| **Lead-In** | the non-detecting section of the sensor cables which carries the signals from the detection unit to the detecting section of the sensor cables |
| **Leaky Cable** | detecting cable. Detecting cable is called "leaky" because it allows rf energy to "leak" out and in. Also called "ported". |

| | |
|---|---|
| **Line Supervision** | electronic protection of an alarm line or remote input line, accomplished by sensing a continuous (coded) signal on the line. An intruder cutting or shorting out the line causes an alarm condition. This is often accomplished by using end-of-line (supervision) resistors. |
| **Load Set** | a device attached to the unused zone in a single zone system. The load set prevents stray signals escaping from the detection unit. |
| **Meter (m)** | 1 meter = 3 ft, 3 in |
| **Medium** | see Burial Medium |
| **Microprocessor** | a solid-state, self-contained computer. Panther has a built-in microprocessor that oversees all operations and decides whether a disturbance was caused by an intruder. |
| **Minor Damage** | a cut less than 1 cm (3/8 in) in length on a sensor cable jacket |
| **Moderate Damage** | a damaged section less than 2.5 cm (1 in) in length on a sensor cable |

**Mutual Interference**

false alarms caused by two adjacent Panthers that are on the same frequency and are too close together

**Non-Detecting Area**

a section of a zone where the detecting field is absent. In circumstances where a section of the perimeter must be non-detecting, a section of the detecting cable is removed, and an equal length of non-detecting cable is spliced in its place. The section removed from the detecting cable must be discarded. It must never be used for splicing, since its interior construction is non-uniform. See Bypass.

**Non-Detecting Section**

the "lead-in" section of the sensor cables

**Obstacle**

an object that requires the re-routing of the sensor cables. Obstacles include metallic fences, lamp standards, trees, and so on. Some obstacles prevent the physical passage of the sensor cables while others can cause false alarms.

**Open Loop**

any configuration where the protected perimeter does not form a closed loop

**Option Selection Switch (DIP Switch)**

10-position switch located on the terminal connection module. It allows you to combine alarm types, enable or disable warning alarms, and determine the type of analog output coming from Panther's output jacks.

**Output Supervision Fault**

occurs when a supervised alarm line is cut or shorted

**Overlapping Coverage**

a method used to prevent weak spots in the detection field. The coverage provided by one zone does not abruptly stop at the cable end. In a two-zone decoupled system, the decouplers allow the zones to overlap at the ends without causing interference. The cable routing at the start of the two zones can also be arranged to provide overlapping coverage.

**Overshoot**

the detection field path at a sharp corner. If a sensor cable is routed around too sharp a turn, the detection field will "overshoot" or swing outwards at the curve. This does not cause a "weak spot", but it does mean that the field doesn't follow the cable route as expected. This can cause false alarms if the overshoot encounters an obstacle which the cable route avoids.

**Perimeter**

the outside border of the site to be protected

| | |
|---|---|
| **Push Pipe** | a length of steel pipe used to tunnel beneath paved surfaces. The pipe is driven through the soil with a sledge hammer and then withdrawn. See Boring Machine. |
| **Receive Cable** | sensor cable which receives a radio-frequency signal |
| **Return** | a disturbance caused in the detection field that is measured by the detection unit. The microprocessor in the detection unit analyzes the return to determine if it was caused by an intruder and requires an alarm. |
| **Routing** | the path followed by the buried sensor cables |
| **RXA, RXB** | receive zone A, receive zone B |
| **Saturation** | condition whereby a zone is so sensitive that the radio-frequency signal overloads the receiver electronics. You can reduce the sensitivity levels to remedy this problem. |
| **Self-Amalgamating Tape** | a type of tape that bonds to itself to form a waterproof layer. See 3M Insulation Tape |

| | |
|---|---|
| **Sensitivity** | a measure of the responsiveness of the system to a stimulus, such as an intrusion. If the sensitivity is set too high, small animals can trigger an alarm. If the sensitivity is set too low, human intruders may be able to cross the perimeter undetected. Sensitivity is set using the controls on the detection unit and a strip chart recorder. |
| **Sensor Alarm** | an alarm generated when an intruder enters the detection field (i.e., crosses the cables) |
| **Sensor Cables** | Panther's buried intrusion-sensing elements. One cable transmits a radio-frequency signal, and the other receives it. The Panther microprocessor analyzes disturbances in the received signal to detect intruders. See Non-Detecting Section, Field-Start Section, and Detecting Section. |
| **Sensor Failure** | failure of the detection unit electronics |
| **Severe Damage** | a damaged section more than 2.5 cm (1 in) but less than 3 m (9 ft, 9 in) in length on a sensor cable |
| **Splice** | used to provide non-detecting sections in the middle of a detecting zone, or to repair a damaged cable |

**Superficial Damage**

a very small cut or scrape on the jacket of a sensor cable

**Supervision Resistors**

line-supervision terminating devices. These are typically used in contact-closure type alarm systems to enable detection of wire-cutting or short-circuiting by intruders. Panther has a module built into the detection unit where supervision resistors can be easily installed if required. See Line Supervision.

**Tamper Alarms**

warning alarms caused by someone opening Panther's top door, or by opening the box housing Panther and activating the external tamper switch

**Terminal Connection Module**

located in the bottom of the Panther detection unit. It's connected to the sensor cables, and allows connections to other equipment, such as an alarm panel.

**Terminator**

a device which provides the correct electrical characteristics at the end of the cable. The ends of all sensor cables must be equipped with terminators (or decouplers for a two-zone decoupled system). See Decoupler.

**Test Failure**

a failure that occurs when the test switch is pressed and the alarm indicators and relays do not activate

| | |
|---|---|
| **3M Insulation Tape** | 3M Scotchfill Electrical Insulation Putty (Tape) |
| **3M Traffic Loop Sealant** | one brand of sealant which may be used when the sensor cables are placed into slots in pavement. See Dow Corning 888. |
| **Transmit Cable** | sensor cable which emits a radio-frequency signal |
| **TXA, TXB** | transmit zone A, transmit zone B |
| **Warning Alarms** | alarms that are triggered by a system fault or by someone tampering with the system |
| **White Mark** | the mark on the sensor cable jacket that indicates the end of the non-detecting section and the start of the detecting section |
| **Zone** | a section of the perimeter. Panther can monitor two separate sets of sensor cables and each one of these can be used to protect a different zone. For systems requiring more than two zones, contact your Panther distributor. |

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